EFFECT OF FESS ON TUBO TYMPANIC DISEASE

Dissertation submitted to

THE TAMIL NADU DR.M.G.R. MEDICAL UNIVERSITY

In partial fulfilment of the Regulations

for the award of the Degree of

M.S., (Oto-Rhino-Laryngology)

BRANCH IV

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TIRUNELVELI

THE TAMIL NADU DR.M.G.R. MEDICAL UNIVERSITY,

CHENNAI,

TAMIL NADU

CERTIFICATE

This is to certify that the Dissertation entitled "**EFFECT OF FESS ON TUBO TYMPANIC DISEASE**" presented herein by Dr.P.Rajeswari, MBBS., is original work done in the Department of Oto-Rhino-Laryngology Tirunelveli Medical College Hospital, and submitted to The Tamilnadu Dr.M.G.R. Medical University, Chennai, in partial fulfilment for the award of M.S (Oto-Rhino-Laryngology) is a bonafide work carried out by her under my guidance and supervision during the academic year 2013-2016. This dissertation partially or fully has not been submitted for any other degree or diploma of this university or other.

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DECLARATION

I, Dr.Rajeswari, MBBS., solemnly declare that the Dissertation titled **"EFFECT OF FESS ON TUBO TYMPANIC DISEASE"** had been prepared by me under the expert guidance and supervision of **Prof.Dr.S.Suresh Kumar, MS.,DLO.,** Professor & HOD Department of Oto-Rhino-Laryngology, Tirunelveli Medical College Hospital, Tirunelveli.

The dissertation is submitted to The Tamilnadu Dr. M.G.R. Medical University, Chennai in partial fulfilment of the regulations for the award of M.S. Degree (Branch IV) in Oto-Rhino-Laryngology.

It was not submitted to the award of any degree/diploma to any University either in part or in full previously.

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ABBREVIATIONS

COM	-	Chronic Otitis Media.
CSOM	-	Chronic Suppurative Otitis Media.
CT	-	Computed Tomography.
DNE	-	Diagnostic Nasal Endoscopy.
DNS	-	Deviated Nasal Septum.
EB	-	Ethmoidal Bulla.
ENT	-	Ear, Nose, Throat.
ET	-	Eustachian Tube.
FESS	-	Functional Endoscopic Sinus Surgery.
IP / OP	-	In Patient / Out Patient.
LP	-	Lamina Papyraceae.
MEM	-	Middle Ear Mucosa.
MMA	-	Middle Meatal Antrostomy.
MT	-	Middle Turbinate.
OM	-	Otitis Media.
OMC	-	Osteo Meatal Complex.
OME	-	Otitis Media with Effusion.
PNS	-	Para Nasal Sinuses.
S	-	Septum.
UP	-	Uncinate Process.
URIs	-	Upper Respiratory Infections.

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CERTIFICATE OF REGISTRATION & APPROVAL OF THE TIREC REF NO: 485/ENT/2013/35

PROTOCOL TITLE: Effect of fess on Tubotympanic disease

NAME OF PRINCIPAL INVESTIGATOR: Dr. P.Rajeswari
DESIGNATION OF PRINCIPAL INVESTIGATOR: Resident in ENT
DEPARTMENT & INSTITUTION: Department of ENT, Tirunelveli Medical College

Dear Dr. P.Rajeswari, *The Tirunelveli Medical College Institutional Ethics Committee (TIREC) reviewed and discussed your application during the IEC meeting held on 28.12.13.*

THE FOLLOWING DOCUMENTS WERE REVIEWED AND APPROVED

1.	TIREC Application Form	☑
2.	Study Protocol	☑
3.	Department Research Committee Approval	☑
4.	Patient Information Document and Consent Form in English and Vernacular Language	☐
5.	Investigator's Brochure	☑
6.	Proposed Methods for Patient Accrual Proposed	☑
7.	Curriculum Vitae of the Principal Investigator	☑
8.	Insurance /Compensation Policy	☐
9.	Investigator's Agreement with Sponsor	☑
10.	Investigator's Undertaking	☐
11.	DCGI/DGFT approval	☐
12.	Clinical Trial Agreement (CTA)	☑
13.	Memorandum of Understanding (MOU)/Material Transfer Agreement (MTA)	☐
14.	Clinical Trials Registry-India (CTRI) Registration	

THE PROTOCOL IS APPROVED IN ITS PRESENTED FORM ON THE FOLLOWING CONDITIONS

1. The approval is valid for a period of 2 year/s or duration of project whichever is later
2. The date of commencement of study should be informed
3. A written request should be submitted 3weeks before for renewal / extension of the validity
4. An annual status report should be submitted.
5. The TIREC will monitor the study
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8. In the events of any protocol amendments, TIREC must be informed and the amendments should be highlighted in clear terms as follows:
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   c. If the amendments require a change in the consent form, the copy of revised Consent Form should be submitted to Ethics Committee for approval. If the amendment demands a re-look at the toxicity or side effects to patients, the same should be documented.
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   g. Any deviation/violation/waiver in the protocol must be informed

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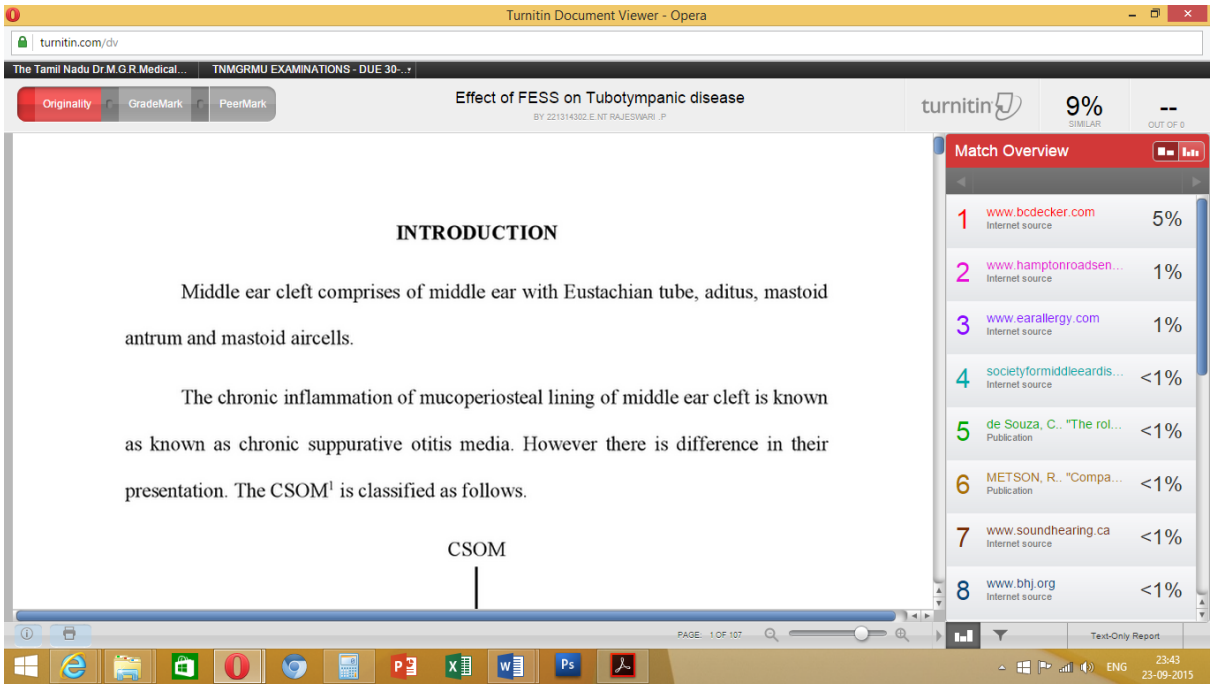
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INTRODUCTION
Middle ear cleft comprises of middle ear with Eustachian tube, aditus, mastoid antrum and mastoid aircells.
The chronic inflammation of mucoperiosteal lining of middle ear cleft is known as known as chronic suppurative otitis media. However there is difference in their presentation. The CSOM[1] is classified as follows.
CSOM
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1 www.bcdecker.com Internet source 5%
2 www.hamptonroadsen... Internet source 1%
3 www.earallergy.com Internet source 1%
4 societyformiddleeardis... Internet source <1%
5 de Souza, C., "The rol... Publication <1%
6 METSON, R., "Compa... Publication <1%
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INTRODUCTION

Middle ear cleft comprises of middle ear with Eustachian tube, aditus, mastoid antrum and mastoid aircells.

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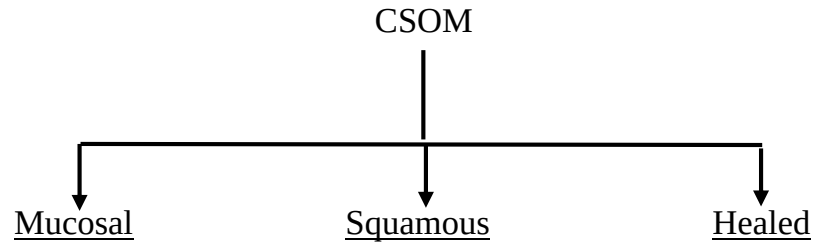


1. Active CSOM	1. Active CSOM	
2. Inactive CSOM	2. Inactive CSOM	

In this thesis work, Tubotympanic type alone was analysed. Nose along with the sinuses is prone to continous environmental changes, viral infections and chronic bacterial infections. The presence of infection in nasopharynx, nose, oropharynx may be a cause of persistent ear discharge in chronic suppurative otitis media[3]. Our clinical study supports the interrelationship between chronic sinusitis, being a focus of sepsis for CSOM[5]. A proper functioning and patent eustachian tube is a must for middle ear aeration and mucociliary transport, effective pressure maintenance between nasopharynx and middle ear. This is more important for normal middle ear function. This is mainly because of proper middle ear aeration and mucociliary transport done by

physiologically patent eustachian tube. This mechanism plays a role in the etiology of CSOM and in the success of myringoplasties.

Deviated nasal septum, turbinate hypertrophy, lateral nasal wall anatomical variations, synechiae all affect the respiratory channel ventilation of sinuses, vocal resonance and nasal reflex functions.

The mucous secretion from the nasal glands form a blanket and their movement is of utmost importance. This movement is altered by presence of infection which leads to chronic sinusitis. The infected secretions from the nose and paranasal sinuses directly pass over to the eustachian tube. It causes inflammation of the lymphoreticular tissue. There by affecting the mucociliary clearance, congestion of the eustachian tube orifice[7]. Thereby the ventilation of the middle ear is affected or the infection ascends to the middle ear via peritubal vessels causing CSOM.

Those patients having both active sinusitis and tubotympanic type of CSOM having ear discharge for long duration are selected. If ear surgery is performed without sinusitis being corrected, it may cause a failure and the outcome of the surgery will be poor.

This study emphasizes the significance of sinusitis as an etiological factor in chronic suppurative otitis media active mucosal type. Clearing the focus of infection from nose and paranasal sinuses by FESS results in resolution of disease from the ear. Thus there is improvement in ear disease without operating on it, by removing the focus of infection in the nose.

AIM OF STUDY

To study the effect of FESS on tubotympanic disease.

OBJECTIVES

1. To establish, rhinosinusitis remain the major cause of tubotympanic disease.
2. To evaluate all tubotympanic disease cases with proper diagnostic nasal endoscopy.
3. To study that FESS clears the focus of infection in tubotympanic disease.
4. To improve the tubotympanic disease by doing FESS.

INCLUSION CRITERIA

- Sex : Both
- Patients with tubotympanic disease, with ear discharge more than 1 month even after antibiotics with radiological proven chronic sinusitis.

EXCLUSION CRITERIA

- CSOM, active squamous, inactive squamous, adhesive otitis media.
- Fungal infection of external ear.
- Reccurent chronic otitis media after surgery.

MATERIALS AND METHODS

The study population consists of tubotympanic type of C.S.O.M. patients with chronic sinusitis who attended the Tirunelveli Govt. Medical College Hospital, Tirunelveli during a 2 year period.

All patients with tubotympanic type of CSOM with radiologically proven chronic sinusitis from Department of ENT, Tirunelveli Govt. Medical College Hospital, Tirunelveli were included in the study. Ear discharge of these patients was sent for culture and sensitivity. The patients were treated with culture directed topical and systemic antibiotics and mucolytic agents and were followed up for a period of 1 month. The patients selected were subjected to diagnostic nasal endoscopy and computed tomography of paranasal sinuses for nasal symptoms and signs. Patients with evidence of chronic sinusitis were treated with antibiotics, antihistamines and decongestions for a period of at least 4 wks. Though they had temporary symptomatic improvement they showed frequent relapse of symptoms. So they underwent endoscopic sinus surgery and were followed up post operatively 3 weeks, 6 weeks, 3 months & 6 months. The patients were assessed by otoendoscopy for decrease in ear discharge and improvement of middle ear mucosal status.

STUDY AREA

Department of ENT, Tirunelveli Govt. Medical College Hospital, Tirunelveli.

STUDY PERIOD

Dec-2013 to Sep2015

METHOD OF STUDY

Prospective study

STUDY POPULATION

A minimum of 104 patients with tubotympanic disease with rhinosinusitis, randomly selected.

SCOPE OF STUDY

The study emphasize the importance of clearing focal infection & ascertain the improvement of tubotympanic disease by doing FESS.

This approach can have a great impact on treatment modalities of tubotympanic disease.

HISTORICAL PERSPECTIVE

BARTOLOMEUS EUSTACHIUS

Eustachius was born in Italy circa 1510 and died in 1574. He was relatively unrecognized in his time because his fine collection of anatomical plates remained unprinted and forgotten in the vatican library until discovered in the early 1700s and presented by Pope Clement to his physician Maria lancisi who published them. Eustachius not only discovered the tube but also described the cochlea, pharyngeal musculature, optic nerves, thoracic duct, adrenal glands and abducens nerve and gave the first accurate description of the uterus.

Eustachius published the first detailed description of the auditory tube in 1562 in his thesis EPISTOLA DE AUDITUS ORGANIS. He wrote; “From the cavity of the petrous bone, there in which the auditory passage called concha such a passage toward the nasal cavity is perforated. Others would perhaps think that this passage, about which this dissertation is being written, ends in that place; this is not so, however, for it is augmented by a substance of different nature and is carried on between two muscles of the pharynx and it ends in either cavity of the nose near the internal part of the root of the apophysis of the bone that is shaped like the wings of the bat, and is inserted in a thick investment of the palate near the root of the uvula. Its substance, where it touches the extremity of the fissure which is common to the temporal and wedgeshaped bones, is cartilaginous, and quite thick; but the substance of the opposite part is not exactly cartilaginous, but is somewhat membranous and becomes thinner gradually; but the internal end of the passage facing the middle of the nasal cavity has a strong cartilage which is very thick and is covered by the mucous membranes of the nares, and is seen

at the end of the same meatus as if it were a guardian. It is not round, but is somewhat depressed and makes two angles. It is as large as writing cane, but is twice as large at the end as at the beginning, which is equally invested by a mucous membrane, which is, however, thinner.

According to POLITZER, Eustachius compared the tube to a writing pen and wrote; “It originates at the anterior course of the base of the skull, and takes an anterior course toward the pterygoid process of the sphenoid bone. It consists of two parts: the first solidly connected with the temporal bone, close to the tympanic cavity; the second soft, partly ligamentous, partly cartilaginous, directed toward the nasopharynx. Cross sections of the tube are not perfectly round and the inner part is twice as wide as the outer.

Also, the inner part adjacent to the nasopharynx is lined with mucous membrane and seems to possess a sphincter at its end. The mucous lining is continuous with the nasal mucosa.”

ANTONIO / ANTONIO MARIA VALSALVA

A century later, Antonio Maria Valsalva (1666-1723) was born in Imola, Italy. He became notable for his description of the aortic “sinus of Valsalva, ” but he is even more famous for his Treatise on the Human Ear. His description of the Eustachian tube is classic, in which he detailed the cartilaginous, membranous, and osseous parts of the tube. He discovered, and named the dilator tubae of the tensor veli palatini muscle and made note of the insertion of some fibers of the tensor tympani into the membranous portion of the tube. He recorded his thoughts on the acoustic functions of the Eustachian tube and supported concept of drainage of purulent material from the middle ear. His

observations on the function of the Eustachian tube resulted in Valsalva's maneuver, which he used in clinical practice and which has persisted to this day. In addition to treatment of middle- ear effusion and negative pressure the maneuver is used as an inflation test for the patency of the Eustachian tube. Most likely, the maneuver was described much earlier, such as by Arab physicians of the eleventh century and some of the early Italian anatomists

JOSEPH TOYNBEE

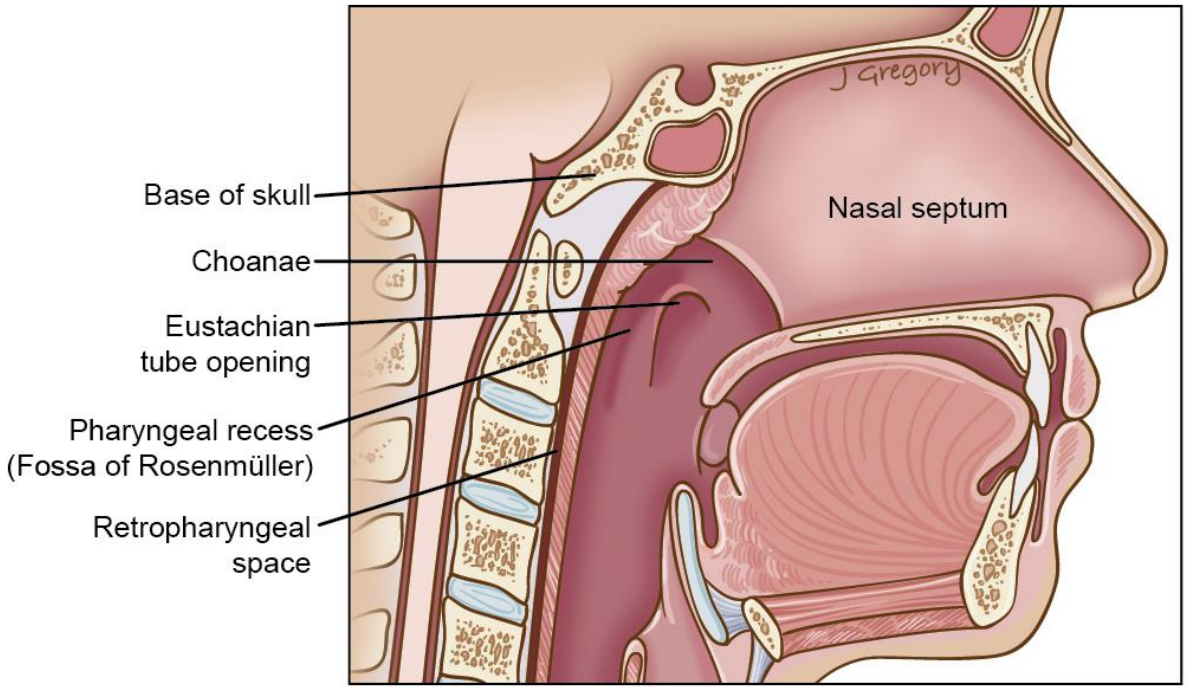
During the nineteenth century, otologists continued the work of Eustachius. Joseph Toynbee (1815– 1866) was an early English clinician who published a textbook on otologic diseases. He was a pioneer in the field of aural pathology and described a method for removing temporal bones from cadavers; he performed over 2,000 dissections of the ear. Among his contributions, he studied the muscles that open the Eustachian tube. He is credited with the eponymous test, the Toynbee test.

ADAM POLITZER

The most famous otologist of the nineteenth century was Adam Politzer (1835–1920), who is universally acknowledged as the father of modern otology. Politzer will be remembered for, among other important contributions, his method of inflating the Eustachian tube–middle ear for treatment of middle- ear diseases. Related to the role of the Eustachian tube in the pathogenesis of middle-ear effusion, his hydrops ex vacuo theory is still considered to be a valid explanation. He wrote: "It is beyond doubt that sometimes in excessive swelling of the tubal mucous membrane and impermeability of the Eustachian tube there occurs in consequence of the of consecutive rarefaction of the air in the tympanum, a transudation of serous fluid". His method politzerization was

recommended to restore middle-ear pressure not only was this Viennese clinician a pioneer in otology, but Professor Politzer was also a scholar who could speak many languages. Related to the Eustachian tube, he translated ancient Egyptian writings that may have been some of the earliest descriptions of the auditory tube. In one such text, the following was stated: "Man has two vessel-strands leading to the right ear, filled with Pneuma, 'BREATH OF LIFE'; two similar strands leading to the left ear conduct the 'BREATH OF DEATH' However, Politzer made no conclusion from these passages that the Egyptians preceded Eustachius in describing the auditory tube. Adam Politzer remains a giant among clinicians and investigators who have helped us understand the role that the Eustachian tube plays in middle-ear disease.

Figure 1: ANATOMY OF NASOPHARYNX



Anatomical location is behind the nose and above the soft palate & passavants ridge. Function is respiratory function. It has rigid and noncollapsable walls.

BOUNDARIES

1. Anteriorly opens into nasal fossa, inferiorly related to soft palate.
2. Connected to oropharynx by nasopharyngeal isthmus which is formed by lower border of soft palate and posterior wall pharynx.
3. Roof and posterior wall by body of sphenoid and basi occiput, and first 2 cervical vertebrae

The dimension of nasopharynx is 4cm high 4cm wide and 3cm long.

Under the mucous membrane the lymphoid tissue collection called adenoids is present. Tubal elevations or torus tubaris surrounds the eustachian tube orifice.

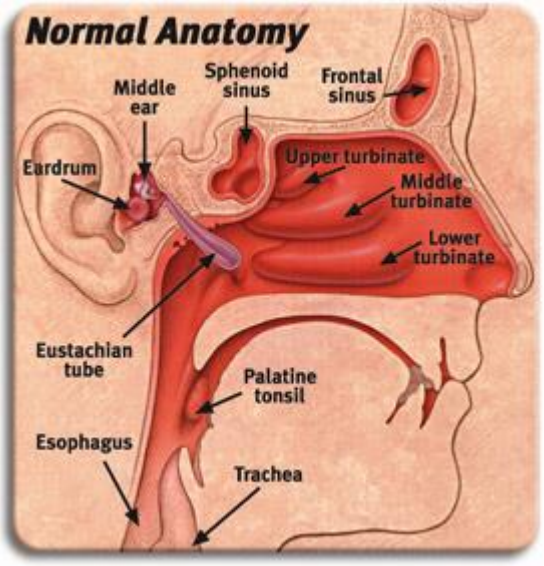
FOSSA OF ROSENMULLER

Fossa of rosen mullar is the deep recess in the base of skull which is the commonest site for nasopharyngeal carcinoma. It is also called as pharyngeal recess.

BOUNDARIES

1. **Anteriorly** by eustachian tube and levator palatine muscle.
2. **Posteriorly** by pharyngeal wall mucosa and pharyngobasilar fascia and retrophayngeal space with lymph node of rouvier.
3. **Medially** it communicates with the nasopharyngeal cavity.
4. **Superiorly** the base of skull till foramenlacerum.
5. **Posterolaterally** (Apex) carotidcanal opening and petrous bone apex posteriorly.
6. **Laterally** tensorpalati muscle and mandibular nerve in prestyloid compartment of parapharyngeal space.

Figure 2: ANATOMY OF EUSTACHIAN TUBE



This links middle ear with nasopharynx. It runs forwards and downwards from the anterior wall of middle ear cavity. The length is 36mm in adult and 18mm in children. The lateral third is bony and medial two third is cartilagenous. The isthmus is the narrowest portion.

The mucosal lining of the eustachian tube is lined by respiratory mucosa with goblet cells and ciliated epithelium on the floor. Towards nasopharyngeal end there are more goblet cells and cilia, & there is respiratory mucosa. In the middle ear end there is less no of goblet cells and cilia.

BONY PORTION

It is in 12mm length. It runs through the squamous and petrous part of temporal bone. It is widest over the anterior wall of middle ear and narrowest at isthmus, which is connected to cartilagenous part.

Roof is formed by tiny plate of bone separating canal for tensor tympani from the tube. The medial carotid canal may impinge on eustachian tube. Lumen is wide sidewards and the shape is oblong.

CARTILAGENOUS PORTION:

The cartilagenous portion (24mm long) gives attachment to peritubal muscles. The cartilage bent at its upper border, forms a longer medial lamina and shorter lateral lamina. The cartilage is fixed in a groove between petrous part of temporal bone & greater wing of sphenoid in skull base. Postero medial wall is cartilagenous & antero lateral wall is fibro cartilagenous. Medial end of cartilage protrudes into nasopharynx to form Taurus tubaris. The apex of cartilage part is attached to the isthmus of bony canal. Nasopharyngeal opening is 1-1.25 cm behind & below the posterior end of inferior turbinate and about 2cm above the hard palate.

MUCOSAL LINING

To the periosteum the mucosal lining is adherent, firmy & thin. It has more mucosal glands. In the cartilagenous portion mucosal lining thick. Ciliary beat is in the direction of nasopharynx. Fossa of Rossenmuller or pharyngeal recess is behind the taurus. In children, peritubally & in fossa of rossenmuller there is lymphoid tissue predominance.

MUSCLES ATTACHED TO EUSTACHIAN TUBE

UPPER PORTION OF TUBE

Formed by tensor palati muscle which has its origin along the lateral cartilagenous lamina. Tensor palati muscle descends & rotates medially around the hamulus of pterygoid 7 expands in the soft palate & comes in contact with opposite fibres to form midline raphe. The inferior part of cartilage is attached to salphingo pharyngeous.

LOWER PORTION OF TUBE

It gives attachment to levator palati muscle.

BLOOD SUPPLY OF EUSTACHIAN TUBE

It is supplied by ascending pharyngeal artery & middle meningeal artery & artery of pterygoid canal. Venous drainage – pharyngeal plexus.

Lymphatics: to retro pharyngeal nodes.

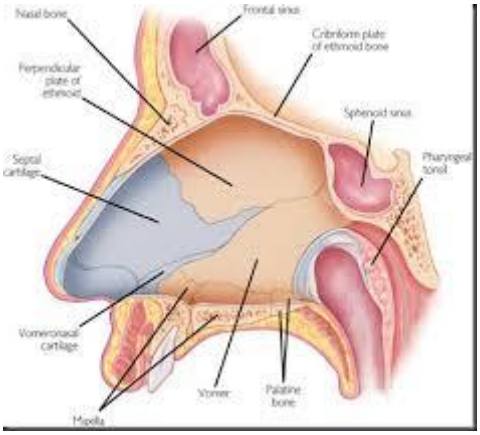
NERVE SUPPLY

Bony portion – supplied by tympanic plexus

Cartilagenous portion – nervous spinosus

Ostium – supplied by pharyngeal branch from sphenopalatine ganglion.

Figure 3: ANATOMY OF NASAL SEPTUM



Nasal septum consists of

1. Membranous portion
2. Cartilage
3. Several bones

It is divided in to

1. Columellar septum
2. Membranous septum
3. Septum proper

Septum proper consist of

1. Perpendicular plate of ethmoid
2. Vomer
3. Two bony crest of maxilla and palatine bone

Cartilagenous portion is made up of quadrilateral cartilage which receives contribution from lower and upper lateral alar cartilage. Foot plate is an area where

cartilage increases the thickness of 4-8mm anteroinferiorly. Cartilage expands in its upper margin where it connects to the upper lateral cartilages and forms anterior septal angle.

Superior and anterior bony septum formed by perpendicular plate of ethmoid. Posterior and inferior nasal septum formed by vomer. Vomerovaginal canals is formed between vomer and ala of rostrum of sphenoid which transmits pharyngeal branch of maxillary artery. Inferior border of vomer articulates with palatine bones and nasal crest of maxilla.

Posterior free edge of septum is formed by posterior edge of vomer.

Development of Middle 3rd of face is based on quadrilateral cartilage of nasal septum.

In adults surface area of septum is 30 to 35 cm2.

According to theile septal deviation is more to the left than right

BLOOD SUPPLY OF NASAL SEPTUM

Important source of blood supply to the nose is external and internal carotid arteries

1. Posteroinferior septum: Supplied by sphenopalatine artery (Branch of ECA)
2. Anteroinferior portion of septum: Supplied by greater palatine artery which enters through incisive canal

Superior labial branch: A branch from facial artery contributes anteriorly in relation to kiessal bach plexus.

It lies in little's area on septum. Where epistaxis is common

Superiorly, septum is supplied by internal carotid artery through anterior and posterior branch of ethmoidal arteries.

Cavernous venous plexus connects to pterygoid plexus via sphenopalatine vessels posteriorly and to facial veins anteriorly. Superiorly, ethmoidal veins connects with superior opthalmic system and into superior sagittal sinus through foramen ceacum which may be direct intracranial connections.

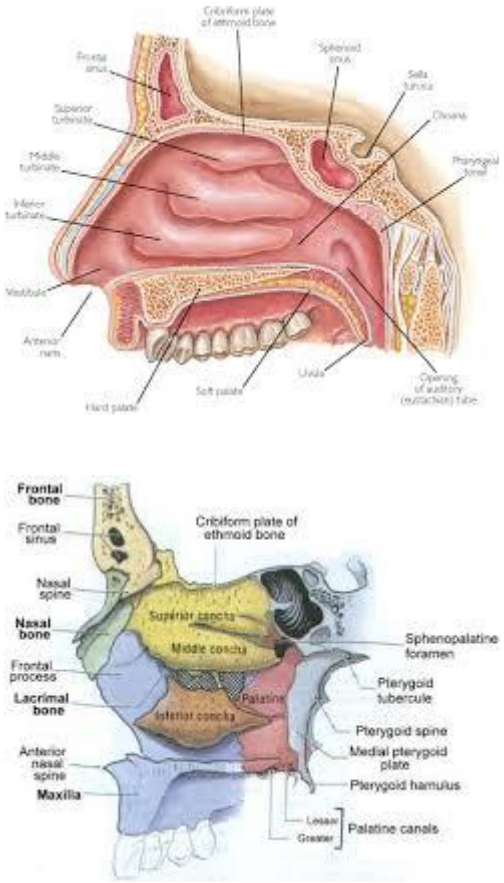
NERVE SUPPLY OF NASAL SEPTUM

1. Sensory supply by maxillary division of trigeminal nerve.
2. Bulk of Bony septum is supplied by nasopalatine nerve.
3. The anterior ethmoidal branch of nasociliary nerve supplies the antero superior part of septum.
4. Anteroinferior part is supplied by anterior superior alveolar nerve.
5. The posterior inferior part is supplied by the nerve to pterygoid canal and anterior palatine nerve.

LYMPHATIC DRAINAGE OF NASAL SEPTUM

The sub mandibular nodes drain the anterior part of septum. The retropharyngeal and anterior deep cervical nodes drain the posterior part of septum.

Figure 4: ANATOMY OF LATERAL NASAL WALL



INFERIOR MEATUS

It is a part of lateral nasal wall lateral to inferior turbinate. It is largest among the three meatuses. The opening of nasolacrimal duct is just anterior to its highest point.

INFERIOR TURBINATE

Inferior concha is a separate bone with a firm mucoperiosteal attachment. At 5th intrauterine month the ossification centre of interior turbinate appears.

The submucous cavernous plexus with large sinusoids provide major contribution to nasal resistance. They are under autonomic control. The respiratory epithelium covers the turbinate with increased number of goblet cells

MIDDLE MEATUS

Lateral to middle turbinate is the middle meatus on lateral nasal wall. The frontal maxillary and anterior ethmoid sinuses drain here.

The key anatomic features of lateral wall of middle meatus are

1. Uncinate process along with its fontanelle
2. Hiatus semilunaris
3. Ethmoidal infundibulum
4. Ethmoidal bulla or Bulla ethmoidalis
5. Lateral sinus
6. Frontal recess

UNCINATE PROCESS

It is a hook like structure. It runs in antero superior to postero inferior direction. It lies immediately posterior to agger nasi. The superior attachment of uncinate process varies. May insert into lamina papyracea, lacrimal bone or skull base. It may swing medially and get inserted into lateral surface of middle turbinate. This leads to variation in drainage of frontal sinus. The middle turbinate hides its upper extremity. Posteroinferiorly it curves down and forms the medial wall of ethmoidal infundibulum while its posterior border forms the posterior margin of hiatus semilunaris in the anteroinferior portion. Posteroinferiorly the uncinate process is attached to ethmoidal process of inferior turbinate. Thus it separates membranous part of lower middle meatus into anterior and posterior fontanelle. In the inferior part of the infundibulum the natural ostium of maxillary sinus is made hidden while the accessory maxillary ostium is seen perforating the anterior and posterior fontanelle.

ETHMOIDAL INFUNDIBULUM

Infundibulum is a space formed medially by the uncinate process and frontal process of maxilla and laterally by lacrimal bone and the lamina papyracea. The anterior wall of bulla ethmoidalis is the posterior extent of infundibulum. Here it communicates with middle meatus via hiatus semilunaris. In the lower part of infundibulum, the natural ostium of maxillary sinus exists. Accessory maxillary sinus ostium is seen in the anterior or posterior fontanelle.

HIATUS SEMILUARIS

Hiatus semilunaris is a two dimensional space 1 to 2mm wide. It lies between anterior wall of ethmoidal bulla and posterior free margin of uncinate process. Ethmoidal infundibulum is entered through hiatus semilunaris

BULLA ETHMOIDALIS

It is an ethmoidal cell. The uncirnate process is found infront of bulla ethmoidalis. The posterior boundary of hiatus semilunaris is formed by anterior surface of bulla. Bulla may be pneumatised or solid according to pneumatisation. Superiorly it extends to skull base and posteriorly it fuses with the ground lamella. It fuses with ground lamella of middle turbinate posteriorly.

AGGER NASI

The position of agger nasi is anterior to the attachments of middle turbinate. It is pneumatised and this is communication with the frontal recess. When an enlarged agger nasi cell occupies the frontal recess, may cause mechanical obstruction to the fluid drainage.

An enlarged and ballooned out middle turbinate because of pneumatisation and is called as concha bullosa.

LATERAL SINUS

It is a variable cleft seen posterosuperior to ethmoidal bulla. It is bounded superiorly by roof of ethmoid, inferiorly by ethmoidal bulla, laterally by lamina papyraecea, medially by middle turbinate posteriorly, it may extend upto bulla and

ground lamella of middle turbinate. It may be communicating with frontal sinus anteriorly.

FRONTAL RECESS

Frontal recess may be defined

1. medially by middle turbinate
2. laterally by
    a. Lamina papyraceae
    b. A small portion of uncinate process
    c. Lacrimal bone.
3. Superiorly by skull base
4. Inferiorly by the attachment of uncinate process and pneumatisation of agger nasi cells.

In the middle meatus the ventilation and mucociliary clearance occurs through frontal recess. Variable anatomy and drainage of frontal recess is because of attachment of superior process of uncinate process and by the insertion of ethmoidal bulla. The ethmoidal bulla may insert into the roof of ethmoidal gallery and form the posterior wall of frontal sinus. By this way this is separated from lateral sinuses. The frontal sinus may open into the middle meatus or the ethmoidal infundibulum according to the anterosuperior insertion of uncinate process. The frontal sinus may be narrowed by prominent ethmoidal bulla or prominent agger nasi cells. Frontonasal duct is a misnomer. It is rarely duct like. It is a twisted bony cavity connecting frontal sinus and nasal cavity. Its shape is decided by its surrounding structure.

FRONTAL SINUS

- The anterior part of frontal recess pneumatises to form frontal sinus.
- It is not developed at birth.
- Appears in the second year.
- At the age of 4 years the upper margin of the frontal sinus is at the level of midvertical height of orbit.
- At the age of 8 years, top of frontal sinus reaches the supra orbital rim.
- At 10 years of age it extends above the orbit.
- There is variable pneumatisation of frontal sinus.
- The size of the two frontal sinus are unequal.
- Both the frontal sinuses are divided by a septum which will not be in the midline.
- There are incomplete numerous septa in the sinus giving a scalloped outline which is characteristic
- The posterior wall of frontal sinus is thin. The dura of anterior cranial fossa is beneath it. So the infections from the frontal sinus can spread to form an extradural abscess through the posterior wall.

MAXILLARY SINUS

- Maxillary sinus is present at birth.
- By two years of age it extends under the infra orbital canal.
- By 9 years into zygoma.
- There is vertical growth of the sinus until the eruption of last molar teeth.
- The shape of maxillary sinus is pyramidal.
- Medial wall of the sinus forms the base.
- Apex into the zygomatic process of maxilla.
- The floor of the orbit forms the roof of the maxillary sinus.
- The alveolar recess forms the floor of maxillary sinus and it has the root of first molar and second premolar.
- The anterior and posterior nasal fontanelle are the two areas present in bony medial wall of the maxillary sinus and they are closed by periosteum and mucous membrane.
- Both anterior and posterior fontanelle have accessory sinus ostia, which can be seen on diagnostic nasal endoscopy.
- The superior part of medial wall of the maxilla has the ostium of maxillary sinus.
- Its opening is present in the inferior part of the ethmoidal infundibulum.

ETHMOID SINUS

Presented at birth until puberty enlargement is there. The medial and lateral plates, the ethmoid bone bounds the sinus. It is related to lacrimal bone antero laterally; the indentations in the frontal bone fovea ethmoidalis is found superiorly. Anterolateral wall of sphenoid sinus, forms the posterior boundary of ethmoid sinus. The thinnest bone, lamina papyracea that is the lateral bony plate of ethmoid is the medial wall of orbit. Middle turbinate, superior turbinate, Middle meatus, superior meatus forms the superior wall. The cribriform plate forms the roof. Dura, olfactory bulb and frontal lobe are in close relation with ethmoidal air cells superiorly. CSF leak or permanent anosmia may result due to injury to cribriform plate.

The openings of ethmoidal air cells are found in the nasal cavity anteriorly and the choana posteriorly. Posterosuperior to superior turbinate is spheno ethmoidal recess. By the ground lamella ethmoidal air cells are divided into anterior and posterior ethmoidal cells.

SPHENOID SINUS

Sphenoid sinus is present at birth but not aerated. Until adulthood pneumatisation occurs but it's not variable and asymmetric. Along the floor of sphenoid sinus is the pterygoid canal having the vidian nerve. The internal carotid artery is in close relation with the optic nerve. The opening of sphenoid sinus is in the sphenoethmoid recess which is posterior to superior turbinate.

THE VASCULAR SUPPLY OF NASAL CAVITY AND PARANASAL SINUSES

It is mainly from the branches of ophthalmic and maxillary arteries.

MAXILLARY ARTERY

- Posterior superior alveolar artery.
- Infraorbital artery in pterygopalatine fossa
- Greater palatine branch.
- Sphenopalatine artery is a terminal branch through the sphenopalatine foramen. It enters the nasal cavity

OPTHALMIC ARTERY

- Anterior and posterior ethmoidal arteries
- Supraorbital artery

NERVE SUPPLY OF PARANASAL SINUSES

Maxillary division of trigeminal nerve and supra orbital nerve forms the major sensory innervation. The anterior and posterior ethmoidal nerves are branches of supraorbital nerve.

PHYSIOLOGY OF NOSE

The nose and paranasal sinuses do many functions[3]. They are as follows:

- Air channel of upper respiratory system.
- Filtering.
- Inspired air humidification.
- Olfaction.
- Vocal resonance.
- Speech.
- Nasal reflex functions.

Lined by pseudostratified ciliated columnar epithelium. Tunica propria with serous and mucous glands lies beneath the epithelium. The inspired air is humidified, filtered, made warm and transmitted. This is the main function. The factors responsible for the physiology of paranasal sinuses are secretion of mucous, clearance and ventilation. Drainage of sinuses need a balance between production and transportation throughout the sinuses. This depends on mucous amount produced, the composition of mucous viscosity, effective ciliary beat, mucosal reabsorption, ostial opening, ethmoid clefts, where the mucous passes into nasal cavity. The drainage and ventilation of frontal and maxillary sinuses depends on the patency of sinus ostia and ethmoidal prechambers.

MUCOUS SECRETION

- The blanket of mucous protects the nasal mucosa is produced by mucoserous nasal glands, intraepithelial goblet cells continuously.
- The two layers of mucous blanket are inner serous layer and the outer viscous layer.
- The cilia beat in the sol phase, i.e., the inner serous layer and the gel phase being transported on the top of sol phase by ciliary beat.
- The balance between the gel phase and sol phase is of utmost importance in the normal mucociliary clearance.
- Normally the fine particles and dust are trapped in the gel phase and transported out of the sinuses with mucous layer.
- This mucous layer is continuously produced and transported from the sinus.
- The mucous layer in the maxillary sinus is renewed every 20-30 minutes.

Hilding (1944) in experiments on dogs showed that ciliary streaming in the sinus always leads to the ostium. India ink placed on the floor of the maxillary sinus spirals somewhat laterally and then upwards to the anterior lateral wall, across this anteromedially and upwards to the ostium. In none was the ink seen to pass through the artificial window in the inferior meatus. In frontal sinus also the flow of mucus occurs in a circular fashion centering at the natural ostium. In sphenoid and ethmoid sinuses the flow is directly towards the natural ostium. The thicker and more tenacious the mucus the more rapidly can the cilia evacuate it (Hilding 1932). The cilia beat in a synchronized (transverse) and metachronize

VENTILATION AND DRAINAGE

Through the delicate prechambers the frontal and maxillary sinuses which are the 2 largest and most important drain into the middle meatus. Into the frontal recess, hour glass shaped cleft the frontal sinus opens. Into the ethmoidal infundibulum the maxillary sinus opens into the lateral wall. The ethmoidal infundibulum and frontal recess living parts of anterior ethmoidal complex, if these prechambers are obstructed, the drainage and ventilation of frontal and maxillary sinuses are impaired. The parasympathetic stimulation leads to serous type of secretion and sympathetic stimulation leads to mucinous secretion.

NASAL BLOOD FLOW

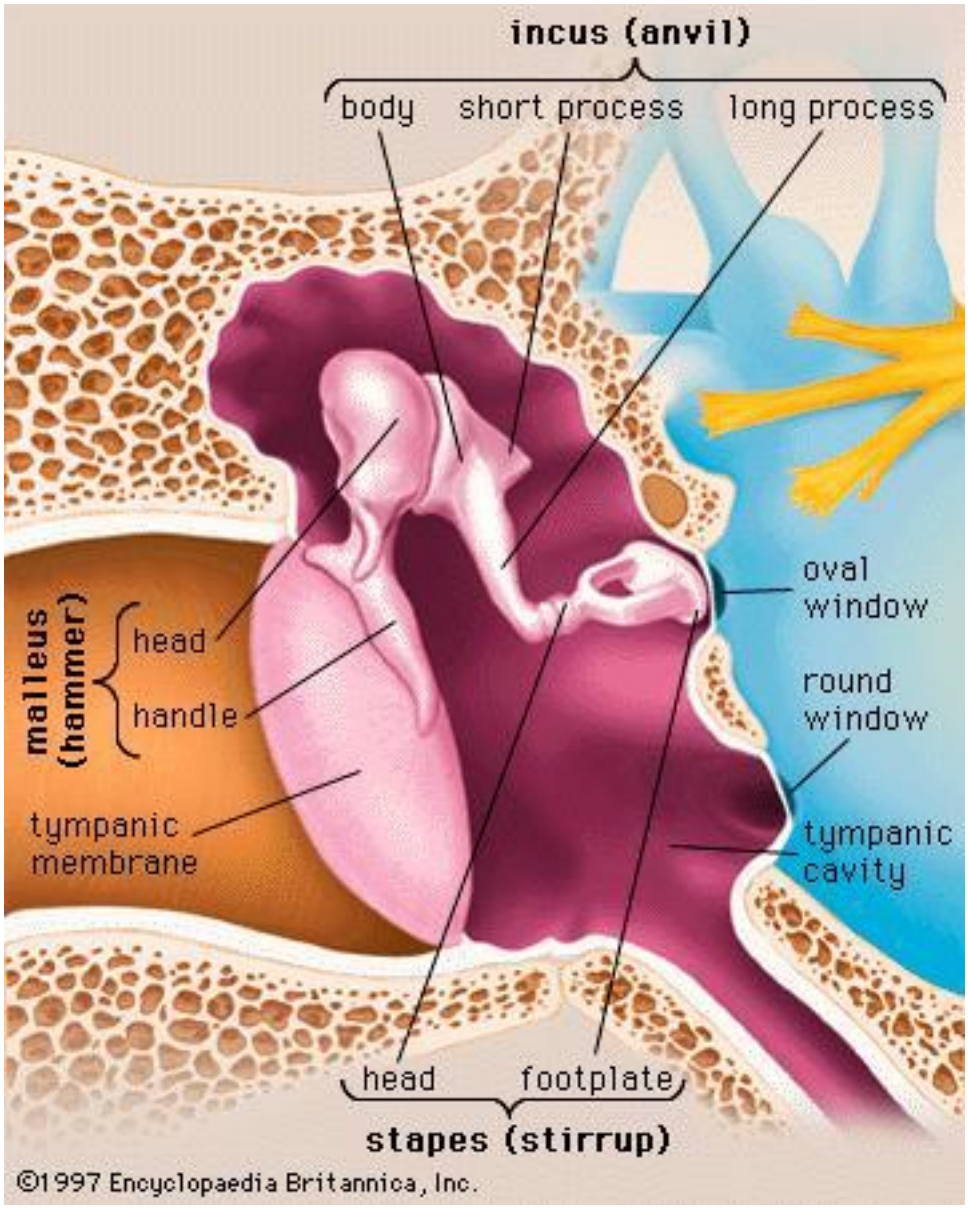
- From both the internal and external carotid arterial systems.
- Main supply is from the sphenopalatine branch of maxillary artery that is a branch of external carotid artery while the anterior and posterior ethmoidal arteries are from ophthalmic artery which is from internal carotid artery.
- The physiological changes in the alternate sides of the nose constitutes the nasal cycle.
- The hydration of decongested mucosa is carried out by the nasal cycle

CHRONIC SINUSITIS BECAUSE OF IMPROPER DRAINAGE AND VENTILATION

The mucociliary system[3] is altered and it leads to chronic sinusitis. Because of bacterial infection, the inflammatory mediators cause increased cellular response and viscosity of mucous with leads to obstruction in sinuses. The partial pressure of O_2 falls.

Entry of air restricted. The growth of anaerobic and facultative organism is facilitated. The granulocyte function also decreases. Because of the anatomical positioning the anterior ethmoidal cells are involved first and these prechambers with narrow ostium causes frontal and maxillary sinus obstruction. In the ethmoid the mucosal swelling and the obstruction leads to improper drainage and ventilation of frontal and maxillary sinuses which are the larger dependent sinuses. Further secondary infections cause worsening of this vicious cycle. The proper mucociliary system and drainage and ventilation are of utmost importance for proper functioning of sinuses thereby preventing sinusitis.

Figure 5: ANATOMY OF MIDDLE EAR



Middle ear cleft: Tympanic cavity, Eustachian tube & mastoid air cells form middle ear cleft. Tympanic cavity is an air filled space within the temporal bone which is irregular in shape between tympanic membrane &the osseus labyrinth medially.

Contents

1. Auditory ossicles
2. Middle ear muscles
3. Tendons that attach them in the cleft.

Tympanic segment of facial nerve which lie along the walls to pass through the cavity.

TYMPANIC MEMBRANE

The end of external auditory meatus is formed by the tympanic membrane. The lateral wall of tympanic cavity is also formed by this shape is oval. Broader above than below. Tympanic membrane forms an angle of 55* with the floor of meatus. The thickened circumference i.e., the tympanic annulus lies in a groove, the tympanic sulcus of temporal bone.

At roof of the canal is the notch of rivinus formed by squamous part of temporal bone. From upper end of sulcus the annulus continues as fibrous band. The anterior and posterior malleolar folds which run centrally to lateral process of malleus. The pars flaccida is a small triangular region in tympanic membrane bound by malleolar folds within the notch of rivinus. The rest of the tympanic membrane is formed by parstensa, which is concave towards ear canal. The tip of handle of malleus is attached to the centre of membrane at the umbo.

The three layers of tympanic membrane are the

1. Epidermis.
2. lamina propria and
3. Mucosal layer from outer to inner.

Epidermis the outer epithelial layer which is a continuation of the skin of external meatus. Lamina propria is the middle fibrous layer. The inner mucosal layer continues with the lining of tympanic cavity.

In the pars tensa the lamina propria fibres are radially arranged in the outer layers & circular, parabolic and transversely oriented fibres in deeper fibres. In the pars flaccida, collagen fibres of laminapropria are less marked and randomly arranged.

The tympanic membrane is supplied by both epidermal and mucosal vessels which form anastamoses in the connective tissue of lamina propria. Epidermal vessels arises from deep auricular branch of maxillary artery from the external auditory meatus.

The anterior tympanic branch of maxillary artery, stylomastoid branch of posterior auricular artery from middle meningeal artery give rise to mucosal vessels.

Nerve supply to tympanic membrane is by auriculotemporal nerve, auricular branch of vagus and tympanic branch of glossopharyngeal nerve.

TYMPANIC CAVITY

Tympanic cavity can be divided into three parts the epitympanum, mesotympanum and hypotympanum.

The epitympanum or attic lies above the level of malleolar folds. Hypotympanum lies below the level of inferior border of tympanic membrane. Mucosal folds and membrane separate the epitympanum from mesotympanum and hypotympanum.

THE LATERAL WALL

Formed superiorly by bony lateral wall of epitympanum, centrally tympanic membrane and inferiorly bony lateral wall of hypotympanum. The epitympanic part is wedge shaped in cross section. Its inferior part is sharp also called scutum. Being thin it is easily eroded by cholesteatoma.

Petrotympanic fissure opens 2mm anterior to tympanic membrane attachment. Anterior malleolar ligament is attached to it anterior tympanic branch of maxillary artery passes through it.

Through the medial surface of this fissure the chorda tympani nerve passes through a separate anterior canaliculus (canal of Huguier). The chorda tympani nerve passes posterior between the layers of tympanic membrane, i.e., fibrous and mucous layers, then passes across the upper part of handle of malleus below the posterior malleolar fold to reach the bony canal, medial tympanic sulcus. It enters the posterior canaliculus then turns obliquely downward and medially to reach the posterior wall of tympanic cavity where it reaches the facial nerve.

ROOF

The thin bony plate that separates the middle ear space from the middle cranial fossa is the roof of epitympanum formed by petrous and squamous parts of temporal bone.

Veins from the tympanic cavity pass through the petrosquamous suture to the superior petrosal sinus.

FLOOR

Separates the hypotympanum from the dome of the jugular bulb. The tympanic branch of glossopharyngeal nerve passess through the small opening at the junction of the floor and medial wall of tympanic cavity. It passes from the base of skull to middle the cavity.

ANTERIOR WALL

It is narrow as the medial & lateral walls converge. The lower 3rd is separated from the carotid artery by a thin plate of bone and it is perforated by superior and inferior caroticotympanic nerves and the tympanic branches of internal carotid artery.

Middle 1/3rd occupied by orifice of eustachian tube. Above it is the canal for tensor tympani. Upper 1/3rd is usually pneumatised. It may lodge an epitympanic sinus which may lodge a residual cholesteatoma in canal wall up surgery.

MEDIAL WALL

Over the basal turn of cochlea covers the promontory with tympanic plexus of nerves formed by tympanic branch of glossopharyngeal nerve.

The kidney shaped oval window which lies behind and above the promontory is closed by the stapes footplate and its annular ligament. It connects tympanic cavity with vestibule. The oval window is related to the facial nerve superiorly and the prominence of promontory inferiorly.

Round window niche lies below and behind the oval window niche of it is separated by subiculum which is the posterior extension of promontory. Ponticulus another ridge of bone situated above the subiculum and runs to the pyramid on the posterior wall of cavity.

The round window niche is triangular in shape. The facial nerve canal or fallopian canal lies above the promontory and oval window in anteroposterior direction. The only straight blood vessels in the middle ear indicate clearly the facial nerve in the canal. The facial nerve canal lies anterior to the processes cochleariformis which houses the tendon of tensor tympani. The facial nerve turns inferiorly behind the oval window in the posterior wall of tympanic cavity.

The medial wall of epitympanum is above the level of facial nerve canal. The dome of lateral semicircular canal is a major feature here.

The triangular relationship between lateral semi-circular canal, short process of incus and facial nerve is very important in cortical mastoidectomy. Above the processes cochleariformis there is a slight swelling corresponding to geniculate ganglion.

POSTERIOR WALL

The posterior wall has an irregular opening the aditus and antrum which connects the mastoid antrum with posterior epitympanum. The fossa incudis below the aditus has

the short process of incus. Below the fossa incudis and medial to chorda tympani is pyramid which houses the stapedius muscle and tendon. Facial recess is a groove between the pyramid and facial nerve and the annulus of tympanic membrane.

The facial recess is bounded medially by facial nerve and laterally by tympanic annulus and the chorda tympani nerve running obliquely in the wall between the two.

The angle between the facial nerve and the chorda tympani permits posterior tympanotomy thereby making access to the middle ear through mastoid without disrupting Tympanic Membrane.

The posterior extension of mesotympanum is sinus tympani, which is deep to promontory and facial nerve.

Cholesteatoma may extend from mesotympanum to sinus tympani which is difficult to eradicate.

Contents of tympanic cavity three Ossicles, two muscles, chorda tympani, and tympanic plexus.

MALLEUS

Most lateral and attached to Tympanic Membrane. Largest of 3 ossicles. It has a head neck and handle. In the epitympanum lies the head being suspended by superior ligament, which runs perpendicular to tegmen tympani. Head of malleus articulates with head of incus by a synovial joint.

The bone has a lateral process, anterior process and handle below the neck of malleus. Anterior and posterior malleolar folds are attached to lateral process of

malleus. Chorda tympani lies on the medial surface of handle of malleus above the insertion of tensor tympani tendon, below the neck of malleus. Anterior ligament attaches between the anterior process and petrotympanic fissure.

INCUS

It has a body and 2 processes. In the epitympanum lies the body and articulates with the malleus via cartilage covered facet. It attaches to tegmen tympani by superior incudal ligament. The short process in the fossa incudis is attached by short suspensory ligament. It has a long process and a medially directed tip called lenticular process. Sometimes there is incomplete fusion of lenticular process. So it also called fourth ossicle.

STAPES

The stirrup shaped stapes has a head, neck, anterior and posterior curare and footplate. Head pointed laterally articulates with the lenticular process of incus. Stapedius tendon is inserted into posterior part of neck and upper part of posterior crus. The curare arise from the neck and join the foot plate which lies over the oval window.

STAPEDIUS MUSCLE

Stapedius arises from the pyramid. Its tendon is inserted into stapes emerging from the apex of pyramid. It is supplied by a facial nerve branch.

TENSOR TYMPANI MUSCLE

It originates from the bony wall of the canal above eustachian tube cartilagenous part of eustuchian tube and greater wing of sphenoid. In the tympanic cavity it lies

below the level of facial nerve on its medial wall and then enters processes cochleariformis turns at right angle and pass laterally to insert into upper end of handle of malleus on its medial aspect. It is supplied by medial pterygoid nerve from mandibular nerve.

CHORDA TYMPANI NERVE

It is a branch of facial nerve that emerges into tympanic cavity through posterior canaliculus at the junction of lateral and posterior walls, passes between mucosal and fibrous layers at tympanic membrane across its medial surface medial to handle of malleus above the level of tensor tympani. It leaves tympanic cavity via anterior canaliculus.

TYMPANIC PLEXUS

Formed by tympanic branch of glossopharyngeal nerve Jacobson's nerve and caroticotympanic nerve (from sympathetic plexus around internal carotid artery) present on the promontory supplying mucous membrane of tympanic cavity, eustachian tube, mastoid antrum and air cells.

MUCOSA OF TYMPANIC CAVITY

Middle ear is lined by ciliated mucus secreting respiratory epithelium and has 3 mucociliary pathways epitympanic, promontrial and hypotympanic which met at tympanic opening of eustachian tube.

The mucosa lines the bony walls, ossicles, ligaments and middle ear muscle tendons as well as carries blood supply to tympanic cavity. The mucosal folds divides

the middle ear cavity into compartments leaving two small openings anterior and posterior isthmus tympani for ventilation of epitympanum from mesotympanum. Cholesteatoma can develop from prussaks space between pars flaccida and neck of malleus bound by lateral malleolar fold.

BLOOD SUPPLY OF TYMPANIC CAVITY

Supplied by internal maxillary artery of external carotid system largely by anterior tympanic and stylomastoid arteries.

MASTOID AIR CELL SYSTEM

An air filled sinus in the petrous part of temporal bone is Mastoid Antrum. Aditus links antrum with middle ear. Floor of middle cranial fossa is formed by roof of mastoid antrum and mastoid air cell space Medial wall is related to posterior semi-circular canal.

Inferiorly

It relates to dura of posterior cranial fossa and endolymphatic sac. Sigmoid sinus lies posterior to endolymphatic sac. Digastric ridge in mastoid bone is important landmark of facial nerve.

Direct lateral relation of mastoid antrum is McEwan's triangle. Mastoid antrum is lined by flattened, non-ciliated epithelium without goblet cells (or) mucus glands.

Trigeminal nerve enters Meckel's cave at the apex of the petrous bone along with abducent nerve. Lateral rectus palsy facial pain and ear discharge comprises **GRADENIGO SYNDROME** which is due to infection at petrous apex.

CHRONIC SUPPURATIVE OTITIS MEDIA

Means permanent abnormality in pars tensa or flaccida. Because of negative middle ear pressure, earlier acute otitis media, effusion with otitis media. However there is difference in their presentation[1]

1. Active CSOM-associated with inflammation and discharge of pus
2. Inactive CSOM-no discharge of pus, but may become active later
3. Healed CSOM-intact pars tensa, there may be healed perforation, abnormality of pars tensa which may be permanent.

According to anatomical position the disease may be classified as tubotympanic and atticoantral disease

Among mucosal CSOM, it is further classified as active mucosal disease and inactive mucosal disease.

Inactive mucosal disease

Perforation in pars tensa which is permanent[10]. No inflammation of middle ear or mastoid mucosa. All layers of pars tensa completely surround perforation. There is perforation of fibrous tissue& the lamina propria is thickened around perforation. There may be medial migration of squamous epithelium into middle ear. The perforation which extends to annulus has propensity to migrate medially.

Active mucosal CSOM

The middle ear mucosa and mastoid is inflamed with chronic disease[5]. There was hypervascularity, infiltration with lymphocytes, plasma cells, histiocytes, submucous

fibrosis with varying degrees of edema. Mucosa ulcerates with granulation tissue formation with proliferation of inflammatory cells, fibroblasts & blood vessels. Tympanic membrane perforates leading to discharge of mucopurulent material. Aural polyps are formed by the progression of mucosal changes and bulges out through the tympanic membrane defect. Inflammatory changes are seen in tympanic cavity and also in mastoid antrum, air cells of temporal bone .Hence it is essential to remove infected mucosa and granulation tissue in active mucosal CSOM to control the disease

Resorption of the ossicular chain may occur in active mucosal CSOM to control 'resorptive osteitis[8]'. This causes hyperaemia of the ossicles with capillary proliferation and histiocyte predominance .The long process of incus and stapes superstructure are most frequently affected probably due to their delicate structure and location. The order of frequency of involvement is as follows-the long process of incus, stapes crurae, body of incus and manubrium.

Bone resorption

Stimuli such as infection, inflammation, pressure and keratin lead to formation of molecular factors like cytokines such as interleukin IL-1, IL-6,TNF, protein mediators-growth factors and nonprotein mediators-prostaglandins, neurotransmitters and nitric oxide. This results in recruitment, development and activation of osteoclasts. Activated osteoclasts cause bone resorption[8].

Foci of cholesterol granuloma –area of cholesterol crystals surrounded by giant cells is demonstrable in some case of active CSOM in the middle ear cleft .There are various hypothesis for the pathogenesis of cholesterol granuloma. Cholesterol crystals

could be break down products of hemorrhage. Middle ear effusion could be the source of cholesterol.

HISTORY OF NASAL ENDOSCOPY

Attempts at upper airway inspection before the 19th century were recorded in the review of the" History of endoscopy, from the earliest times of Bozzini " by Killian in 1915[72].

The first "Light conductor, or description of a simple device and its use for the illumination of internal cavities and spaces of the live animal body" was described in an article published in 1806 by Philip Bozzini. It was possible to see around the corner, inside the cavities of the human body with this device.

Initially examination was spatially and temporally limited since the source of light was sun. The success was greatly weather dependent. This was followed by the use of artificial light sources such as candles, kerosene and oil lamps, gas, gasogene, a mixture of 95% alcohol &turpentine and lime light produced in a lime cylinder heated to incandescence by oxyhydrogen flame or oxygen & coal gas mixture.

A glowing platinum wire was the first electric light. But it required generator driven by steam engine for steady illumination. It also caused concern to the eyesight.

Bozzini visualised some areas behind the soft palate using his light conductor in 1806[72].A mirror of size two franc piece was used in the examination of choana and larynx by Baumes in 1838.

Czermak in 1859 used a technique to view the nasopharynx, choana & posterior aspect of nose which was like laryngoscopy of Truck. This procedure is called endoscopy today.

Zuckerkandl in1882 published an universally accepted reference work. The Anatomy of Nose & of pneumatic attachments]. Koller used cocaine as surface anaesthetic. Jellinek used this as topical anaesthetic in ear, nose, and throat area.

Rontgen discovered this rays to carry his name in 1895.Killian sculptured his rhinoscopic media in 1896.

Hirschman and Valentin used a modified cystoscope through an enlarged dental alveolus into the maxillary sinus in 1902.in 1903 Hirschman resected middle turbinate from the ethmoids. A foreign body in the maxillary sinus was removed by Binder using an endoscope in 1904.

Zollner in 1942 stated that nasal endoscopy is accepted by the wide circle of ENT specialists and this has been invented in Germany itself. In 1956 fundamental improvement has been made in the optics of endoscopy by Hopkins[73]. This comprises of a separate light source, endoscope, and excellent resolution with high contrast perfect fidelity of colour. Though the diameter of endoscope is small the field of vision is large. Because of this new endoscopes endoscopy of upper airways gained popularity in 1970s.The clefts and recesses of nose were reached with the help of Hopkin's rod rigid nasal endoscopes. The key area of infection of para nasal sinuses i.e., the anterior ethmoid sinus within the middle meatus is reached only with these endoscopes.

A systematic endoscopic diagnostic approach to the lateral wall of the nose demonstrated the frontal and maxillary sinuses. This study was done by Messerklinger in 1950[73].

DIAGNOSTIC NASAL ENDOSCOPY

Using 4% xylocaine (local anaesthetic) with oxymetazoline (decongestant) nose packed along the inferior meatus, middle meatus and septum on both sides.

After 15 minutes pack removed, using 0˚Hopkins telescope rod diagnostic nasal endoscopy done. The main aim is to see the

1. Patency of the Eustachian tube
2. Structural change of tubal eminence
3. Discharge from middle meatus or sphenoethmoidal recess which was flowing over the Eustachian tube orifice.

   In osteomeatal complex area, anatomical variants like

1. Medialised uncinate
2. Prominent bulla
3. Enlarged middle turbinate are noticed.

COMPUTED TOMOGRAPHY SCANNING OF PARANASAL SINUSES

All the selected patients underwent CT scan paranasal sinuses both coronal and axial view, 3000 Hu units bone window.

Following findings were noted:

1. Medialised uncinate
2. Blockage of osteo meatal complex
3. Mucosal thickening / Retention cyst in maxillary sinus
4. Concha bullosa
5. Mucosal thickening in anterior and posterior ethmoids
6. Type of skull base. Keros classification
7. Enlarged middle turbinate
8. Agger nasi cells with obstruction to frontal recess
9. Type of frontal cell causing obstruction to frontal recess

CT SCAN PNS (According to Mark May)

Grade 0 : Normal

Grade 1 : Minimal – Disease limited to OMC

Grade 2 : Moderate – Incomplete opacification of one or more sinuses (Frontal, maxillary, sphenoid).

Grade 3 : Maximal – Complete opacification of one or more major sinuses, but not all

Grade 4 : Most severe – Total opacification of all sinuses

OTOENDOSCOPY

Using 0° Hopkins rod, 4mm otoendoscopy done for all the patients. Following findings were documented.

1. Type of perforation
2. Quadrants involved
3. Middle ear mucosal status
4. Discharge

The patients selected for the study had various anatomic variations in the nose and paranasal sinuses, and signs suggestive of chronic sinusitis on diagnostic nasal endoscopy and computed tomographic scanning of paranasal sinuses. When these patients were put on medical treatment for a period of at least 4 weeks they were either unresponsive or showed frequent relapse of symptoms.

The patients underwent functional endoscopic sinus surgery by Messerklingers technique. Concurrent septal correction was done if required. The surgery in each case was based on the extent of disease. Simultaneous with the post-operative care given to the healing nasal cavity, the patient was assessed every 3 weeks, 6 weeks, 3 months, 6 months by otoendoscopy for decrease in ear discharge and improvement of middle ear mucosal status. The patients were followed up for a period of at least 6 months.

REVIEW OF LITERATURE

Chronic otitis media is recurrent or persistent infection of the middle ears. When there is a dysfunction of the eustachian tube, air cannot fill the middle ear. This creates a negative pressure, which can lead to fluid buildup in the middle ear, infection of the middle ear, a retraction of the eardrum, and/or a perforation of the eardrum. Major causes of eustachian tube dysfunction include: immature eustachian tube development in the child, the common cold, allergic rhinitis, nonallergic rhinitis, acute or chronic sinusitis, adenoid hypertrophy, and nasopharyngeal tumours. If the function of the Eustachian tube does not improve, chronic otitis media will develop in one of three forms: recurrent secretory otitis media or chronic otitis media with a perforation, retraction pocket, or cholesteatoma.

The American academy of allergy and immunology has officially recognized that inflammation in the middle ear is simply an extension of chronic mucosal disease of the nasal and upper airway passages. Furthermore, it has been demonstrated that the mucosa of the middle ear is capable of mounting an allergic immunologic response similar to that seen in the rest of the upper respiratory system mucosa when confronted by an antigen challenge. Inflammation in the nasopharynx and the pharyngeal portion of the Eustachian tube is considered to be closely related to the tubal constriction, which represents a considerable part of the cause of tubal ventilatory dysfunction.

The lining mucous membrane of the middle ear and eustachian tube is connected with and is the same as membrane of nose, sinuses and throat. Infection of these areas results in mucous membrane swelling which in turn may result in eustachian tube obstruction.

Blue stone in 1989 studied about 40 patients & found "Eustachian tube dysfunction is the main reason for middle ear disease. Disease of the sinuses and upper respiratory tract which causes ET dysfunction." Adenoids contribute less in comparison to the sinus disease causing eustachian tube blockage.

Bluestone, 1971; Bluestone et al[1]; 1970, 179.b; and Hanjo et al[67] 1981.

In 1869 Politzer[76] first described in his literature and in 1931 it was also noted by Proetz that there is a relationship between patients with rhinosinusitis and chronic otitis media. KOCHS study of 222 patients was the first to include observations of Eosinophila in Otorrhea "Supporting the contention that the middle ear takes part in allergic reactions similar to those seen in the nose and sinuses"

In the article "role of nasal and sinus surgery in otitis media" Dr. S.P.Wagh and Dr. Mahesh Bhaya emphasize "The effect of changes in the nose and paranasal sinuses are often felt in the middle ear. The conduit that reflects these changes is the Eustachian tube. Otitis media is frequently secondary to Eustachian tube dysfunction, which in turn is often a result of infections originating in the nose and paranasal sinuses. The rest of the respiratory tract is also influenced by disease that occur in the nose and sinuses. Thus it is logical to treat nasal and paranasal disease simultaneously to achieve a positive outcome in the treatment of otitis media."

They further said "Normal function of the nasal and sinus cavities is influenced by the structures in the nasal cavity. Structural problems in the nose and sinuses will adversely affect their normal functions, leading to disease and possibly disrupting the function of the Eustachian tube[71]. Surgery to correct nasal and paranasal will prevent

these problems from affecting the eustachian tube". Nasal and paranasal surgery has dual purposes. They are (1) restoration of the normal functioning of the nose and paranasal sinuses, and (2) prevention of recurrent attacks of otitis media and infection of the respiratory tract.

As described by Dr. Anand Shah, (BH & MRC, Bombay 2002), he explained "Nose and paranasal sinuses by their situation are the cause of most ear diseases. Diagnosis and treatment of nasal condition is important for successful treatment of the Ear Pathology[74]. Proper evaluation of the nasal and sinus condition in relation to the ear pathology can avoid many unnecessary nasal and otological surgeries. Patience in trying out conservative treatment before suggesting surgery is a necessary virtue. It is mandatory for every otologist to be able to carry out a good diagnostic nasal endoscopy to detect nasal and paranasal pathology causing persistent otitis media."

In an observation made by Mark. J Lerenson (Esic 2002), when persistent discharge develops in ear, then it is extremely important to rule out history of upper respiratory infection, colds and sinusitis[75].

As otologists our primary aim is resolution of ear pathology and successful outcome in cases of surgical intervention. Very often, overlooking the basic pathology in nose or sinuses may result in compromising the results.

In a 1996 publication of Operative Techniques in Otolaryngology / Head and Neck Surgery, DeSouza and co-workers state "The effects of changes in the nose and paranasal sinuses are often felt in the middle ear and that OM is frequently secondary to dysfunction of the ET resulting from such nasal and sinus diseases[76]". They conclude

“It is logical to treat nasal and paranasal sinus disease when it is clinically evident that these processes are a contributing cause of OM”. These investigators proposed “Surgery to correct nasal and paranasal sinus problems restores the normal functioning of the nose and paranasal sinuses., prevents these problems from affecting the ET, and assists in the treatment of patients with OME or COM”. DeSouza and colleagues also proposed “Pathologic nasal conditions can cause OM as a result of edema in proximity to the ET and subsequent obstruction of this orifice and by insufflation of contaminated nasal secretions into the middle ear.” These investigators support the use of surgical procedures, such as septoplasty, turbinoplasty, creation of nasal antral windows, and endoscopic sinus surgery, to correct anatomic conditions that results in chronic and recurrent nasal and sinus diseases and thereafter in OM[72].

RESULTS

Statistical Analysis:

The measurable variable such as age was analyzed and inferred between the genders by means and compared the difference by student's t test. The dichotomous categorical variables improvements between pre and post-operative periods were compared and inferred by McNemar (χ^2_{paired}) test. The polychotomous variables improvements between pre and post-operative periods were compared by either condensing to dichotomous or by leaving the non-improvement categories and applied McNemar (χ^2_{paired}) test. The others were applied Karl Pearson Chi – squared (χ^2) test. The above statistical procedures have been performed by the statistical package namely IBM SPSS statistics-20. The P values less than 0.05 ($P<0.05$) were considered as statistically significant.

Results:

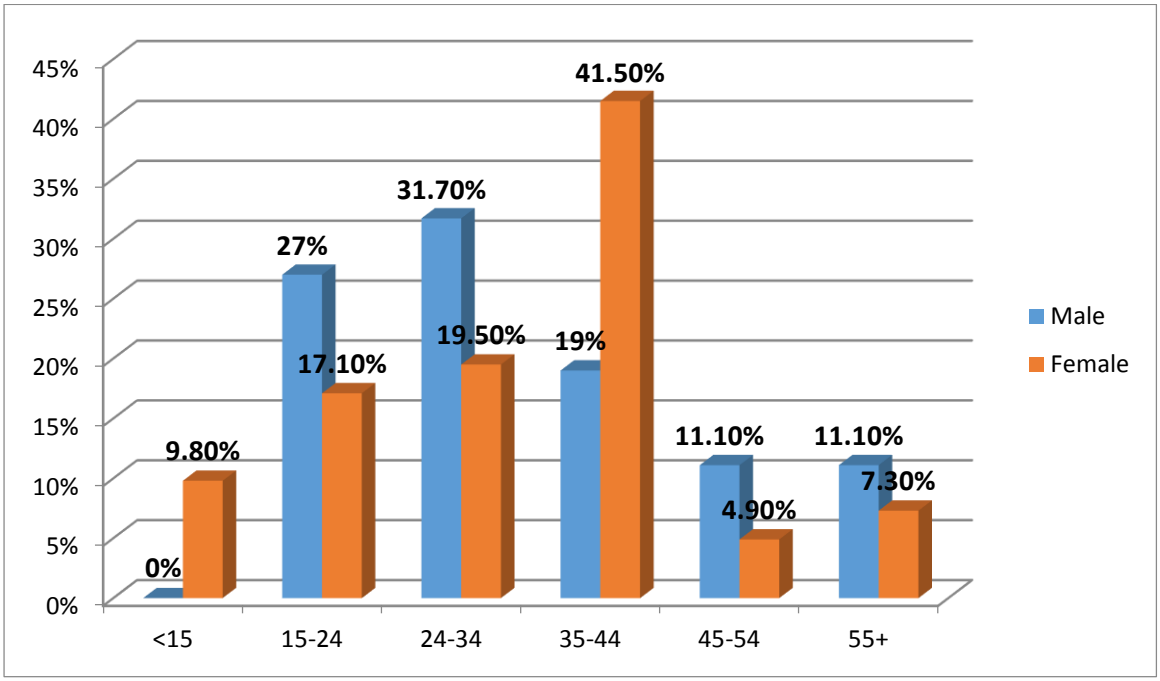
Demographic profile:

The study subjects were described according to their age and sex and compared between sexes.

Table: 1.Age and Sex wise distribution of study subjects:

Age group	Male		Female		Total	
	Frequency	%	Frequency	%	Frequency	%
< 15	0	0.0	4	9.8	4	3.9
15-24	17	27.0	7	17.1	24	23.1
25-34	30	31.7	8	19.5	28	26.9
35-44	12	19.0	17	41.5	29	27.9
45-54	7	11.1	2	4.9	9	8.7
55+	7	11.1	3	7.3	10	9.6
Total	63	100.0	41	100.0	104	100.0
Mean ±SD	34.0±13.2		32.8±13.0		33.5±13.1	
Significance	P>0.05				Range-6 to 67 years	

Chart 1: Age and Sex wise distribution of study subjects



Among the total subjects the males 60.6% and females were 39.4%. The mean age of males was 34.0±13.2 years and the same of the females was 32.8±13.0 years. The difference was not statistically significant (P>0.05). The male and female participation was 60.6% and 39.4% respectively.

Pre and Post-operative description:

The pre-clinical incidences like Septum, prominent middle turbinate, Medialised Uncinate Process, Enlarged Bulla, Prominent Agar, Polyps, CTPNS, Size of Perforation and Middle Ear Mucosal Status have been described in terms of percentages of study subjects. The recurring incidences were also described as post-operative diagnosis. Those incidences were corrected before surgery would not be recurred as post-operative incidences.

Table-2: Pre-clinical and diagnostic manifestation of study subjects:

Manifestations	Incidence	Frequency n=104	%
Septum	DNS	69	71.7
	Midline	35	33.7
Prominent Middle Turbinate	Absent	55	52.9
	Present	49	47.1
Medialised Uncinate Process	Absent	64	61.5
	Present	40	38.5
Enlarged Bulla	Absent	31	29.8
	Present	73	70.2
Prominent Agar	Absent	79	76.0
	Present	25	24.0
Polyps	Absent	93	89.4
	Present	11	10.6
CTPNS	Grade-I	18	17.3
	Grade-II	45	43.3
	Grade-III	24	23.1
	Grade-IV	17	16.3
Size of Perforation	Small	25	24.0
	Medium	32	30.8
	Large	47	45.2
Middle Ear Mucosal Status	Congested	104	100.0

Chart 2: Pre-clinical and diagnostic manifestation of study subjects

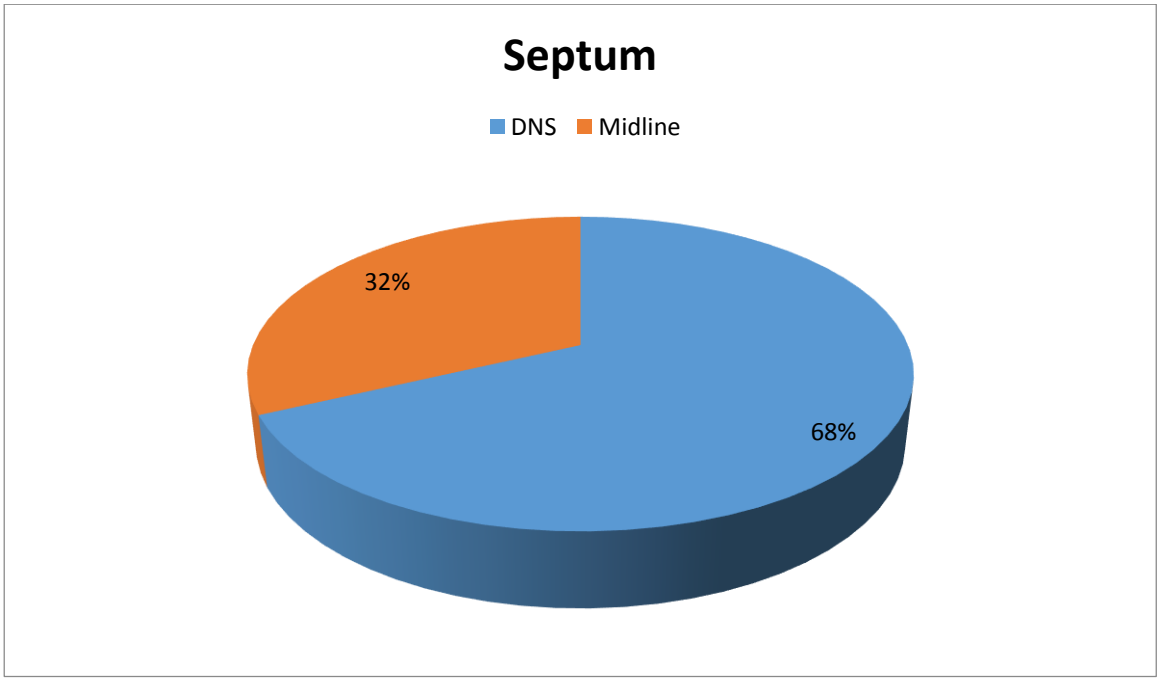


Chart 2.1:

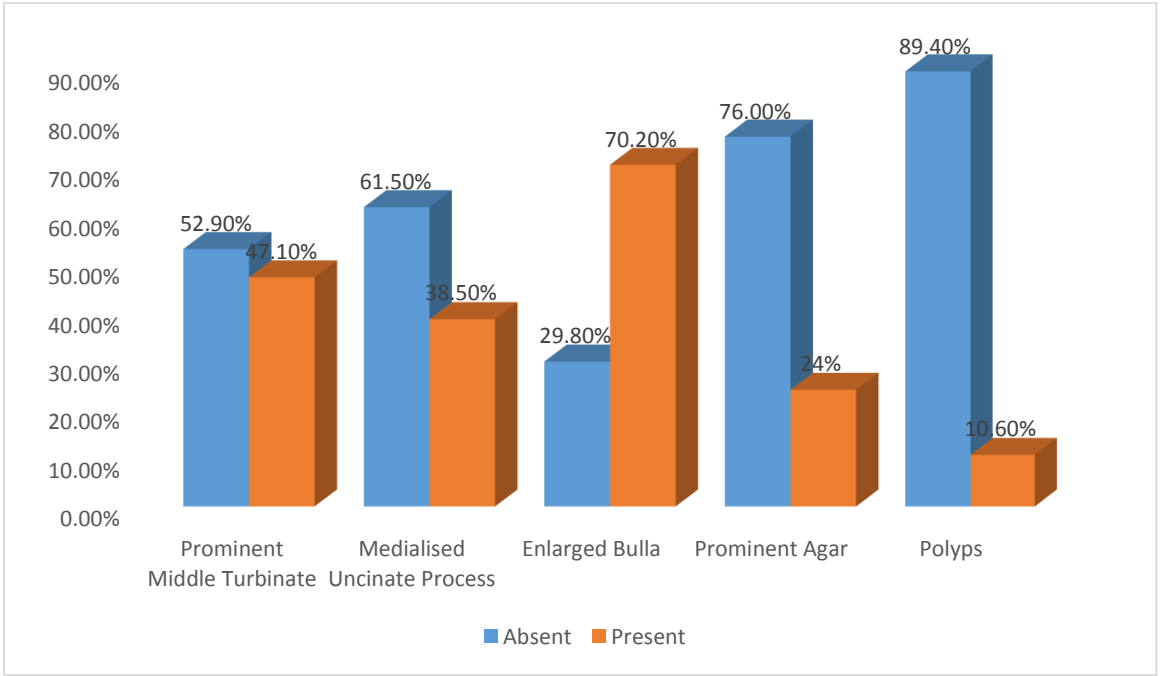


Chart 2.2:

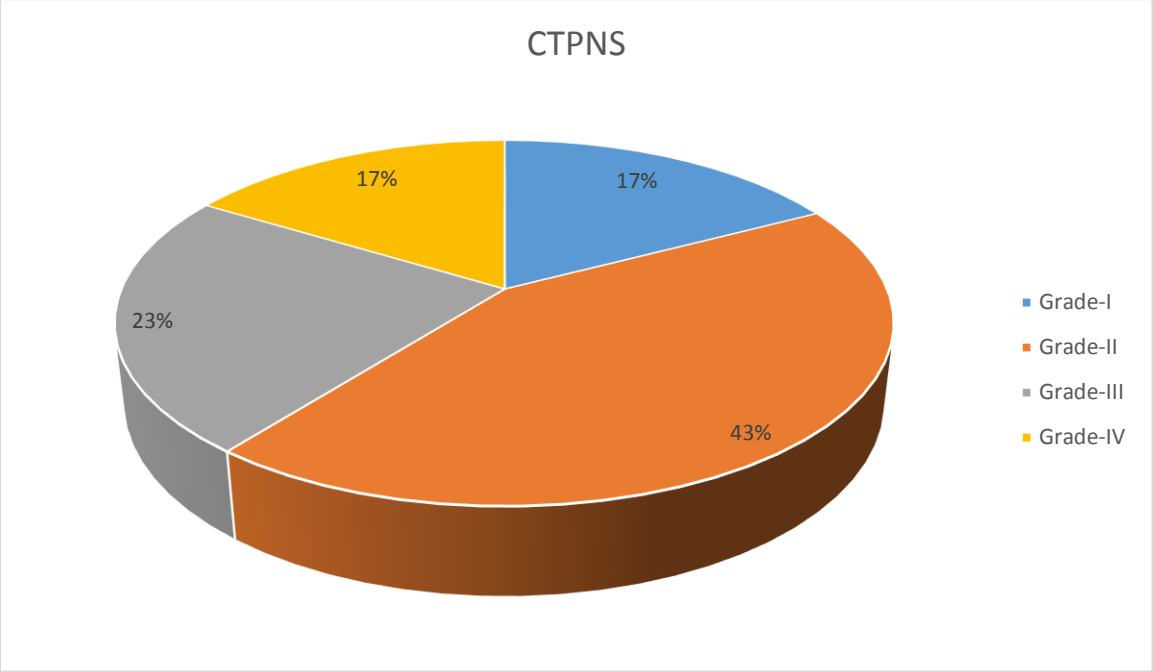


Chart 2.3:

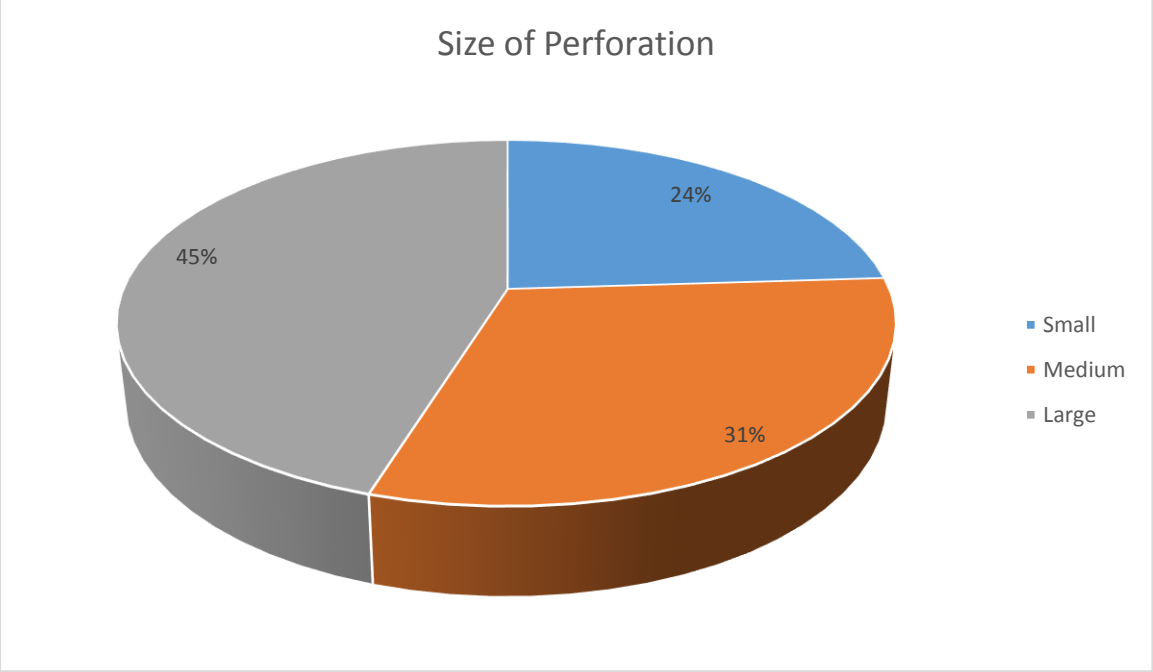
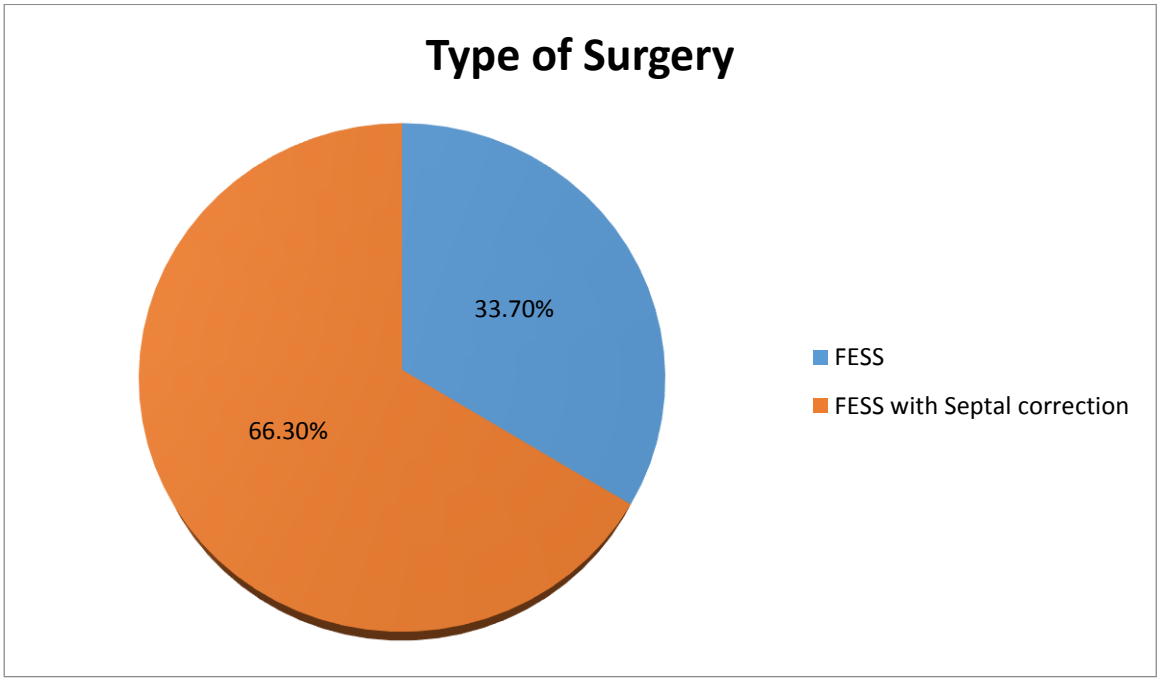


Chart 2.4:

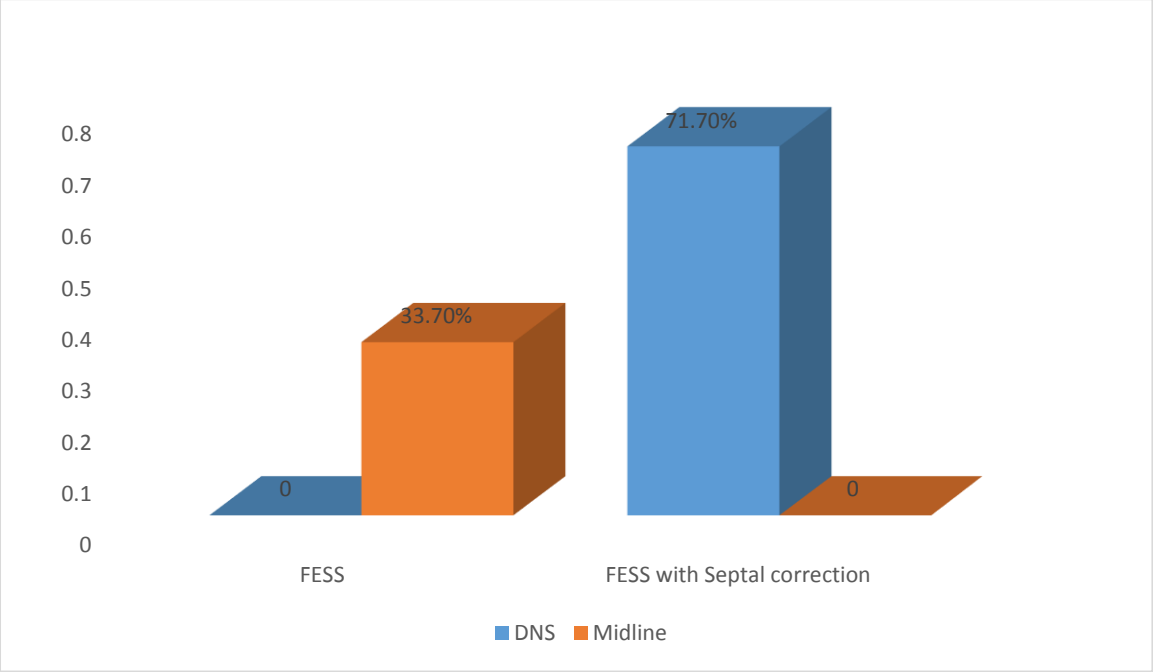


The pre operatives, the septum was treated by surgery. The Medialised Uncinate Process, Enlarged Bulla, Prominent Agar and Middle Ear Mucosal Status were corrected along with surgery.

Table: 3. Distribution of subjects according to surgical procedures.

Type of Surgery	DNS		Midline		Total	
	No	%	No	%	No	%
FESS	0	0.0	35	33.7	35	33.7
FESS with Septal correction	69	100.0	0	0.0	69	66.3
Total	69	100.0	35	100.0	104	100.0

Chart 3: Distribution of subjects according to surgical procedures



FESS was done for 33.7% of the subjects. The remaining 66.7% of subjects had undergone FESS with Septal corrections procedures.

Table: 4. Post-operative Characteristics of study subjects:

Character	Position	Frequency	%
Crust	Absent	97	93.9
	Present	7	6.7
Prominent Middle Turbinate	Absent	82	78.8
	Present	22	21.2
Discharge	Absent	30	28.8
	Present	74	71.2
Synechiae	Absent	79	76.0
	Present	25	24.0
Polyps	Absent	84	80.8
	Present	20	19.2
MMA Size	Not patent	47	45.2
	Patent	57	54.2

Chart 4: Post-operative Characteristics of study subjects

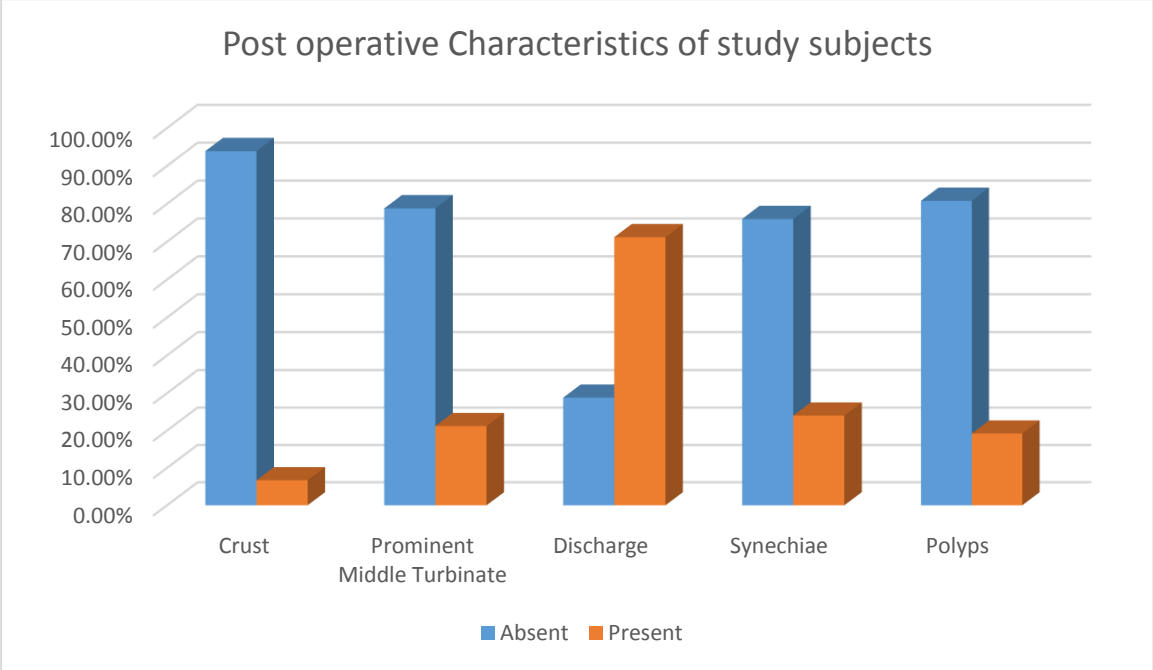
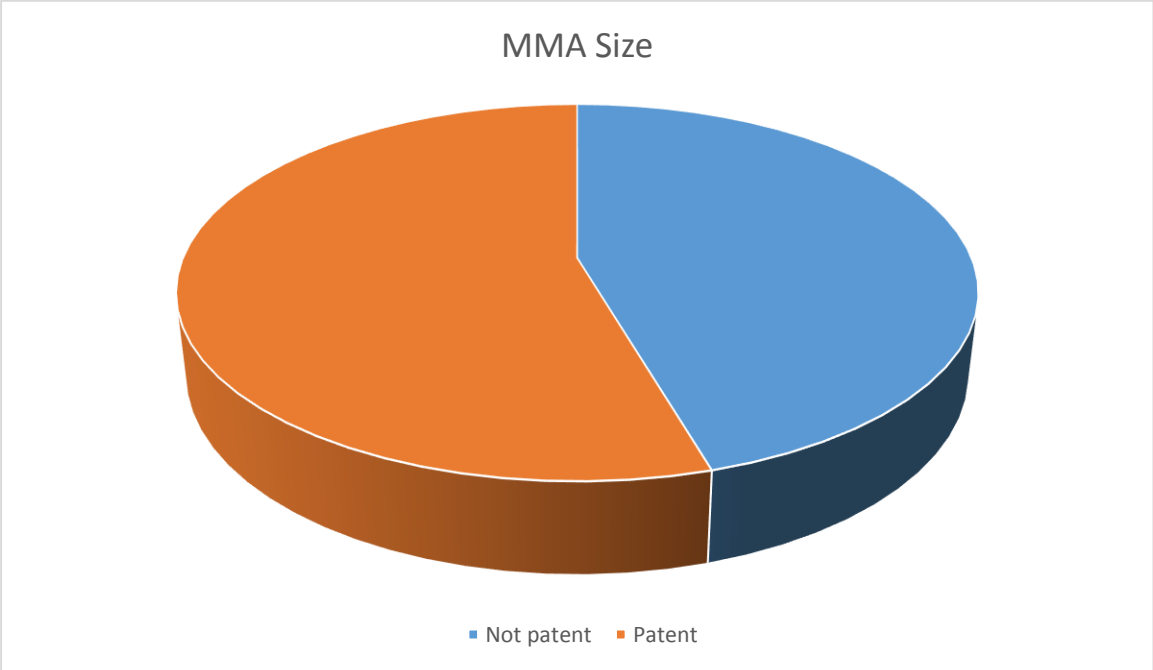


Chart 4.1:



After surgery, the crust was absent 93.9% of the subjects. The Turbinate was for 78.8% of the subjects. The discharge was absent among the 28.8% of the subjects. The

Synechiae was absent 80.8% and for 76.0% of subjects. The Polyps was absent for80.8%. The MMA sizes were Patent and not patent 54.2% and 45.2 % respectively.

Table:5. Comparison of pre and post-operative improvement of Turbinate:

Pre	Post		Total		χ^2_{paired}	df	Significance
	Absent	Present	No	%			
Absent	52	3	55	52.9	20.485	1	P<0.001
Present	30	19	49	47.1			
Total	82	22	104	100.0			
%	78.8	21.2	100.0				

The improvement of Turbinate after surgery was statistically significant (P<0.001).

Table:6. Comparison of pre and post-operative improvement of Polyps:

Pre	Post		Total		χ^2_{paired}	df	Significance
	Absent	Present	No	%			
Absent	79	14	93	89.4	14.000	1	P<0.001
Present	0	11	11	10.6			
Total	79	25	104	100.0			
%	78.8	21.2	100.0				

The improvement of polyps after surgery 89.4% was statistically significant (P<0.001).

Pre and post-operative Perforations status:

Table-7.Comparison of pre and post-operative 3rd and 6th weeks of Perforations:

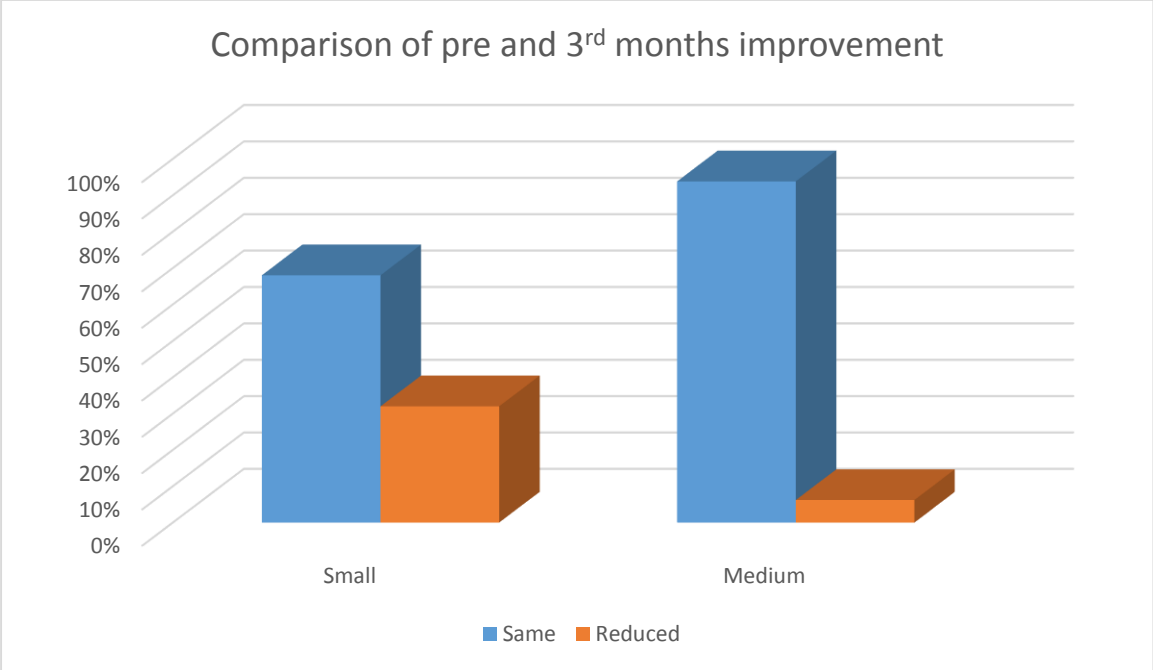
Type of Perforations	Number at Pre-Operative	At 3rd week same		At 6th week same	
		No	%	No	%
Small	25	25	100.0	25	100.0
Medium	32	32	100.0	32	100.0
Large	47	47	100.0	47	100.0
Total	104	104	100.0	104	100.0

The pre-operative perforations were continued as same at 6th week of surgery and the large size perforations were continued as same as on 6th months also.

Table:8. Comparison of pre and 3rd months improvement.

Type of Perforations	Number at Pre-Operative	At 3rd Months				χ^2	df	Significances
		Same	%	Reduced	%	4.776	1	P<0.05
Small	25	17	68.0	8	32.0			
Medium	32	30	93.8	2	6.2			
Total	57	47	82.5	10	17.5			

Chart 5: Comparison of pre and 3rd months improvement



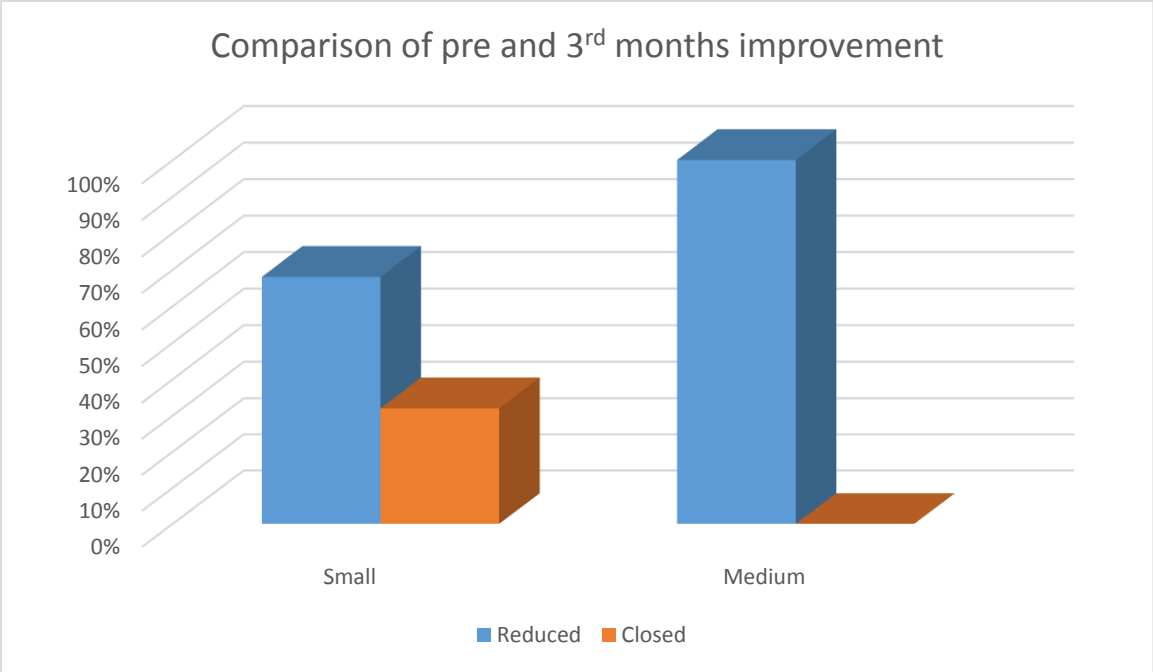
At 3rd month 32% of subjects showed improvement by reduction among the small perforations. Similarly, the medium showed only 6.2% of reduction.

The reduction of small perforation was statistically significant (P<0.05)

Table:9. Comparison of pre and 6th months improvement.

Type of Perforations	Number at Pre-Operative	At 6th Months				χ^2	df	Significance
		Reduction in size	**%**	**Closed**	**%**	9.407	1	P<0.01
Small	25	17	68.0	8	32.0			
Medium	32	32	100.0	0	0.00			
Total	57	49	86.0	8	14.0			

Chart 6: Comparison of pre and 6th months improvement



At 6th month all the small perforation cases were improved either reduced (68%) or closed (32%) and the medium size perforation were improved (100%) as reduction. The reduction and closed was statistically significant (P<0.05).

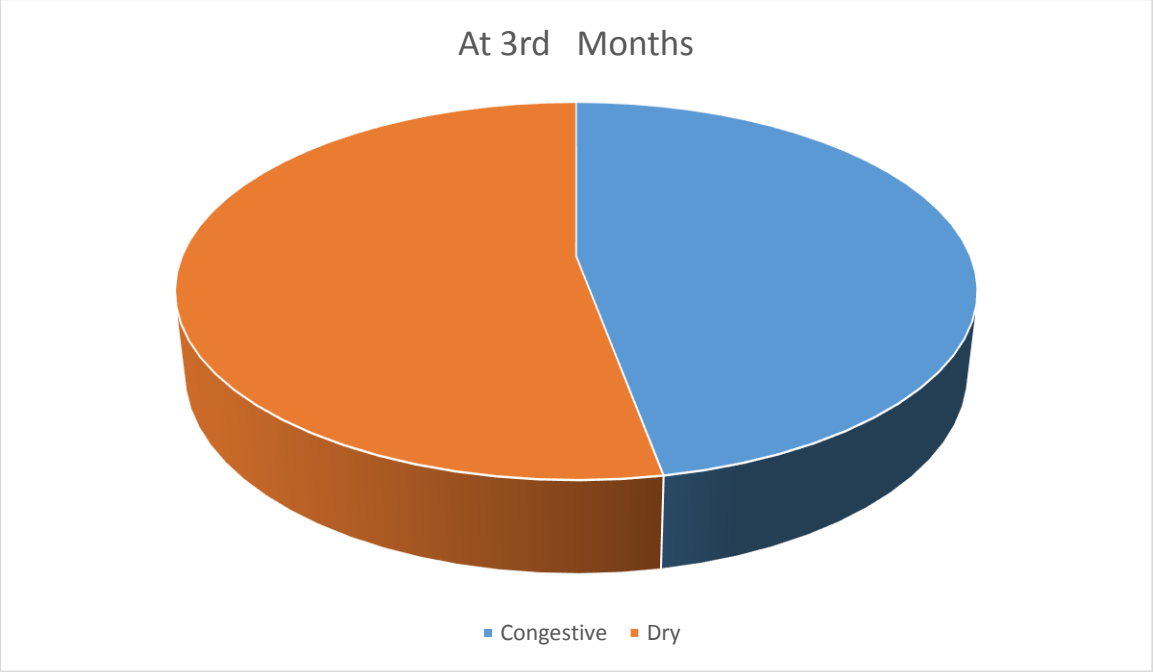
Pre and Post-operative MEM status:

The MEM statuses pre to 3rd and 6th weeks of surgery all subjects were congestive without any improvement.

Table: 10.Comparison of Pre to 3rd month improvement of MEM status.

MEM Status	Number at Pre-Operative	At 3rd Months		χ^2_{paired}	df	Significant
		No	%	53.018	1	P<0.01
Congestive	104	49	47.1			
Dry	nil	55	52.9			
Total	104	104	100.0			

Chart 7: Comparison of Pre to 3rd month improvement of MEM status

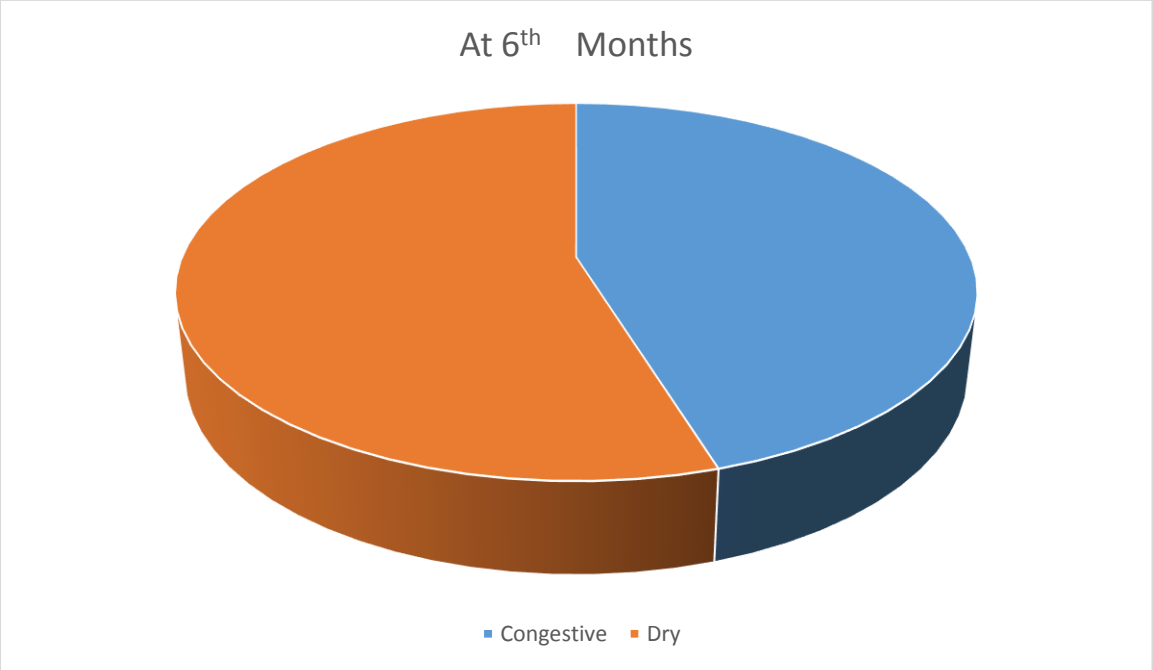


The 100 percent congestive at pre and post-operative periods 3rd and 6th weeks were reduced to 47.1% and dry was improved to 52.9% at 3rd month. The above improvement was statistically significant (P<0.001).

Table: 11.Comparison of Pre to 6th month improvement of MEM status.

	Number at Pre-Operative	At 6th Months		χ^2_{paired}	df	Significance
		No	%	55.018	1	P<0.01
Congestive	104	47	45.2			
Dry	nil	57	54.8			
Total	104	104	100.0			

Chart 8: Comparison of Pre to 6th month improvement of MEM status

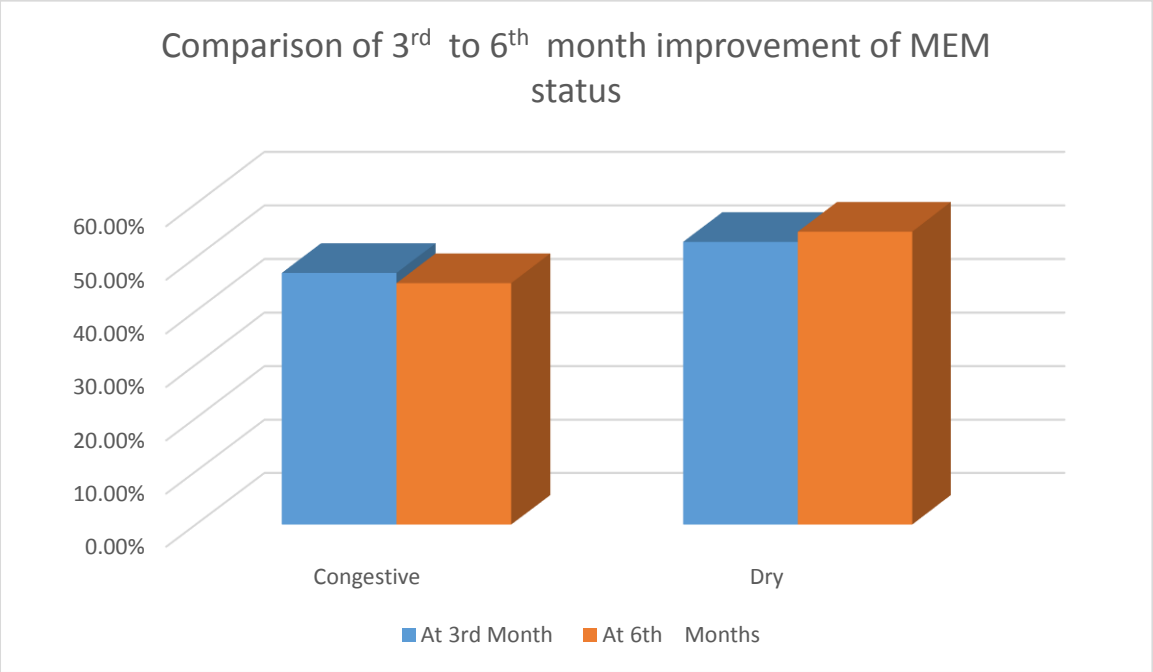


The 100 percent congestive at pre and post-operative periods 3rd and 6th weeks were reduced to 45.2% and dry was improved to 54.8% at 6th month. The above improvement was statistically significant (P≥0.001).

Table: 12.Comparison of 3rd to 6th month improvement of MEM status.

MEM Status	At 3rd Month		At 6th Months		χ^2_{paired}	df	Significance
	No	%	No	%	0.627	1	P>0.05
Congestive	49	47.1	47	45.2			
Dry	55	52.9	57	54.8			
Total	104	100.0	104	100.0			

Chart 9: Comparison of 3rd to 6th month improvement of MEM status

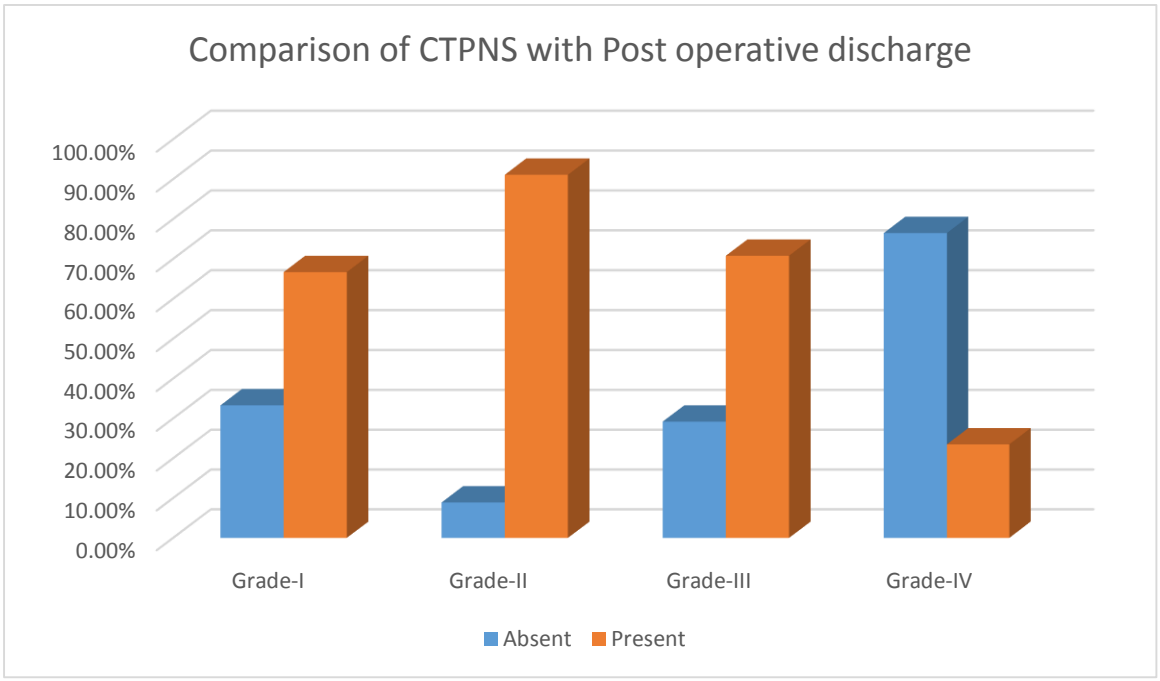


The improvement of dryness from 52.9% at 3rd month to 54.8% at 6th month was not statistically significant (P>0.05).

Table: 13. Comparison of CTPNS with Post-operative discharge:

CTPNS	Post-operative discharge						χ^2	df	Significance
	Absent		Present		Total				
	No	%	No	%	No	%			
Grade-I	6	33.3	12	66.7	18	100.0	27.696	3	P<0.001
Grade-II	4	8.9	41	91.1	45	100.0			
Grade-III	7	29.2	17	70.8	24	100.0			
Grade-IV	13	76.5	4	23.5	17	100.0			
Total	30	28.8	74	71.2	104	100.0			

Chart 10: Comparison of CTPNS with Post-operative discharge

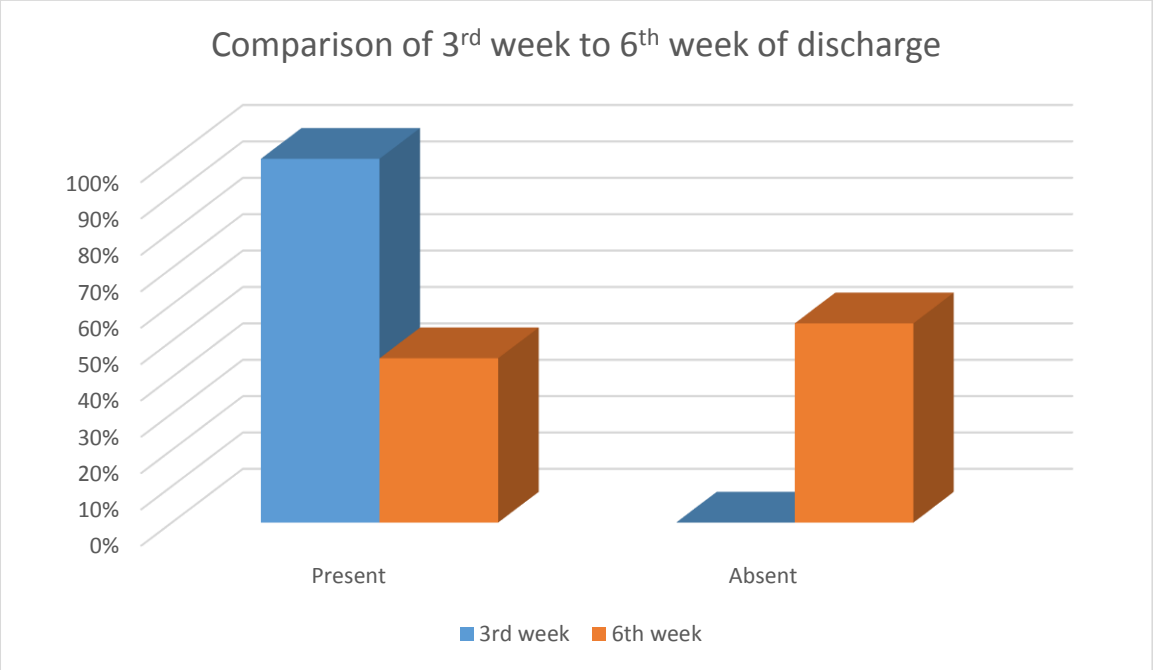


The above table 13 states the discharge from pre-operative to post-operative period. In respect of grade I and II absent of discharge was 33.3% and 8.9% respectively. Grade III and IV the absent of discharge was 29.2% and 76.2% respectively. The total absent was 28.8%. The improvement by means of absent from pre-operative period to post-operative period was statistically significant ($P<0.001$).

Table:14. Comparison of 3rd week to 6th week of discharge:

Condition	3rd week		6th week		χ^2_{paired}	df	Significance
	No	%	No	%			
Present	104	100.0	47	45.2	55.018	1	P<0.001
Absent	0	0.0	57	54.8			
Total	104	100.0	104				

Chart 11: Comparison of 3rd week to 6th week of discharge



The discharge at 3rd week of post-operative period was 100%. The same was absent 54.8% at the 6th week of operation. The improvement was statistically significant (P<0.001).

In respect of discharge the same status quo was maintained in 3rd and 6th months of operation.

Discussion Points:

1. The pre and post-operative characteristics.
2. Comparison of pre and post-operative characteristics.
3. Comparison of pre to 3rd week through 6th month in respect of Viz. perforation, MEM status and discharge.

DISCUSSION

A total of 104 patients were selected for the purpose of this study. These patients with persistent ear discharge had tubotympanic type of chronic suppurative otitis media even after medical management.

In this study we try to emphasize that sinus pathology is a major factor for persistently active tubotympanic disease[5]. Even though other septic foci like chronic tonsillitis, adenoids exist, the percentage is less in comparison to sinus disease[5].

This study of 104 patients over the study period. December 2013 to September 2015 included 63 males and 41 females. Maximum number of patients belonged to age group 35-44 yrs.

In our study, diagnostic nasal endoscopy was done for all patients.
69 patients (66.3%) had septal deviation, 70.2% had enlarged bulla which was the most common anatomical variant, 49% had prominent middle turbinate , 40% had medialised uncinate process, 25% had Prominent Agar,11% had Polyps,

On CT Scan paranasal sinuses, majority of cases had Grade I disease (18%) i.e. minimal disease limited to OMC followed by Grade II (45%) i.e. moderate incomplete opacification of one or more sinuses, 24% had Grade III – complete opacification of one or more major sinuses, not all and 17% of patients had Grade IV disease – total opacification of all sinuses. The most common anatomic variant on CT scan was deviated nasal septum in 69 patients. Medialised uncinate with maxillary mucosal thickening was found in 40 patients while enlarged bulla narrowing OMC was seen in 73 patients. Prominent agger or a type of frontal cell obstructing the frontal recess was found in 25 patients.

All the patients had anatomic variants and signs strongly suggestive of chronic sinusitis on diagnostic nasal endoscopy and CT scan PNS.

Blue stone etal[75] in 1989 studied about 40 patients & found "Eustachian tube dysfunction is the main reason for middle ear disease. Disease of the sinuses and upper respiratory tract which causes ET dysfunction". Our study correlates with the above study.

On otoendoscopy, 25 patients (24%) were found to have a small central perforation involving the anterior quadrant. 47 patients (45.2%) had a large central perforation involving anterior and posterior quadrants while 32 patients had a medium central perforation.

Middle ear mucosal status assessed by otoendoscopy is a reflection of Eustachian tube function[71]. 104 patients has congested middle ear mucosa reflecting poor eustachian tube function.

KOCHS study of 222 patients was the first to include observations of Eosinophila in Otorrhoea "Supporting the contention that the middle ear takes part in allergic reactions similar to those seen in the nose and sinuses. This is because of the changes in the Eustachian tube. The infection in the nose and paranasal sinuses leads to Eustachian tube dysfunction. This Eustachian tube dysfunction leads to Otitis media[75]".

The patients underwent functional endoscopy sinus surgery by Messerklinger technique for the treatment of chronic sinusitis, so as to improve eustachian tube function[78].

The preoperative, the septal deviations were corrected by surgery. The prominent middle turbinate, medialised uncinate process, enlarge bulla, prominent agar, polyps were also corrected along with surgery.

In the postoperative period, diagnostic nasal endoscopy was done. There were no crusts in 93.9% of patients. The prominent turbinates were corrected in 78.8%. The discharge was absent among 28.8% of patients.

The synechiae was absent in 76% postoperative recurrent polyp formation was not there for 80.8%. The MMA sizes were patent for 54.2%. The improvement of turbinate after surgery was statistically significant. $p<0.001$.

The improvement of polyps after surgery was 89.4% and it was statistically significant. $p<0.001$.

Dr.Anand Shah, (BH & MRC, Bombay 2002), emphasized "The situation of nose and paranasal sinuses, being close to ear is the reason for the most ear diseases[74]. So before doing surgery for ear diseases it will be better to evaluate the nose and the sinuses conditions, for good outcome".

The comparison of pre & post-operative changes in third and sixth weeks of post-operative period were same.

At 3rd month 32% of subjects showed improvement by reduction among the small perforations. Similarly, the medium showed only 6.2% of reduction. The reduction of small perforation was statistically significant. $p<0.05$.

At 6th month all the small perforation cases were improved either reduced (68%) or closed (32%) and the medium size perforation were improved (100%) as reduction. The reduction and closure was statistically significant. $p<0.05$.

The MEM statuses pre to 3rd and 6th weeks of surgery all subjects were congestive without any improvement.

The 100 percent congestive at pre and post-operative periods 3rd and 6th weeks were reduced to 47.1% and dry was improved to 52.9% at 3rd month. The above improvement was statistically significant. $p<0.001$.

The 100 percent congestive at pre and post-operative periods 3rd and 6th weeks were reduced to 45.2% and dry was improved to 54.8% at 6th month. The above improvement was statistically significant. $p\geq0.001$.

In respect of CTPNS grading grade I and II absent of discharge was 33.3% and 8.9% respectively. Grade III and IV the absent of discharge was 29.2% and 76.2% respectively. The total absent was 28.8%. the improvement by means of absent from pre operative period to post operative period was statistically significant. $p<0.001$.

The discharge at 3rd week of post-operative period was 100%. The same was absent 54.8% at the 6th week of operation. The improvement was statistically significant. $p<0.001$.

Among 104 patients, at the end of six months of regular follow up after fess, in otoendoscopy the improvement of middle ear mucosal status was found 57 patients i.e., dry. Discharge was absent in 57 patients.

Among 104 patients the perforation remained closed in 8 patients. The size of perforation has reduced in 49 patients and 47 patients the size of perforation remain same.

The closure was the improvement among small perforations and the reduction in size is present in medium and small size perforations.

If these patients with improved status are further treated with cortical mastoidectomy or myringoplasty as the case may be they will definitely have a better outcome.

CONCLUSION

- In the adult population sinusitis is the most important cause of persistent ear discharge in tubotympanic disease.
- Deviated nasal septum, enlarged bulla and prominent middle turbinate are the most common anatomical variants of nose and paranasal sinuses predisposing to sinusitis.
- The clearance of sinusitis has a favorable effect on improving the middle ear mucosal status.
- The clearance of sinusitis by endoscopic sinus surgery in tubotympanic patients results in good outcome of tubotympanic disease clearance.
- Functional endoscopic sinus surgery has emerged as an effective and reliable procedure for clearance of sinusitis.

PROFORMA

Name: Age: Sex:

IP/OP. No:

Address:

Occupation:

Chief Complaints:

EAR

A. Discharge

I. Duration

II. Onset

III. Nature

IV. Colour

V. Amount

VI. Smell

VII. Blood stained

VIII. Aggravating / Relieving Factors

IX. Associated Symptoms

B. Hard of Hearing

Onset

Unilateral / Bilateral Gradual / Fluctuating

C. Earache D. Vertigo / Tinnitus

NOSE

A. Nasal Obstruction

- Continuous / Intermittent

B. Nasal Discharge

- Scanty / Profuse

- Colour

- Smell

C. Headache D. Anosmia E. Post Nasal Drip F. Sneezing

H/o Previous Treatment – Medical / Surgical Clinical Examination:

EAR Right Left

Pinna

Preauricular Region

Postauricular Region

External Auditory Canal

Tympanic Membrane

Perforation

Site

Size

Small Large Medium

Middle Ear Mucosa

Congested

Dry

NOSE

Anterior Rhinoscopy

Posterior Rhinoscopy

Sinus Tenderness

Cold Spatula Test

THROAT

Tonsils – Normal / Hypertrophied / Shrunken

Posterior Pharyngeal Wall – Normal / Granular / Congested /

Postnasal Drip

DIAGNOSTIC NASAL ENDOSCOPY:

First Pass	Right	Left
Inferior Turbinate		
Ridges / Spicules		
Eustachian Tube Orifice		
Mucosa		
Movement		

Secretions

Nasopharynx

Choana

Others

Second Pass

Sphenoethmoidal Recess

Superior Turbinate

Superior Meatus

Others

Third Pass

Head of Middle Turbinate

Uncinate Process

Ethmoidal Bulla

Accessory Ostia

Middle Meatus Discharge

Medical management of Chronic Sinusitis:

- Antibiotics
- Antihistamines

- Decongestants

Surgery : FESS / FESS with septal correction / Otoendoscopy after clearance of sinus disease:

Middle Ear Mucosal Status: Congested / Dry

CT PARANASAL SINUSES

Figure 6: CONCHA BULLOSA WITH DEVIATED NASAL SEPTUM

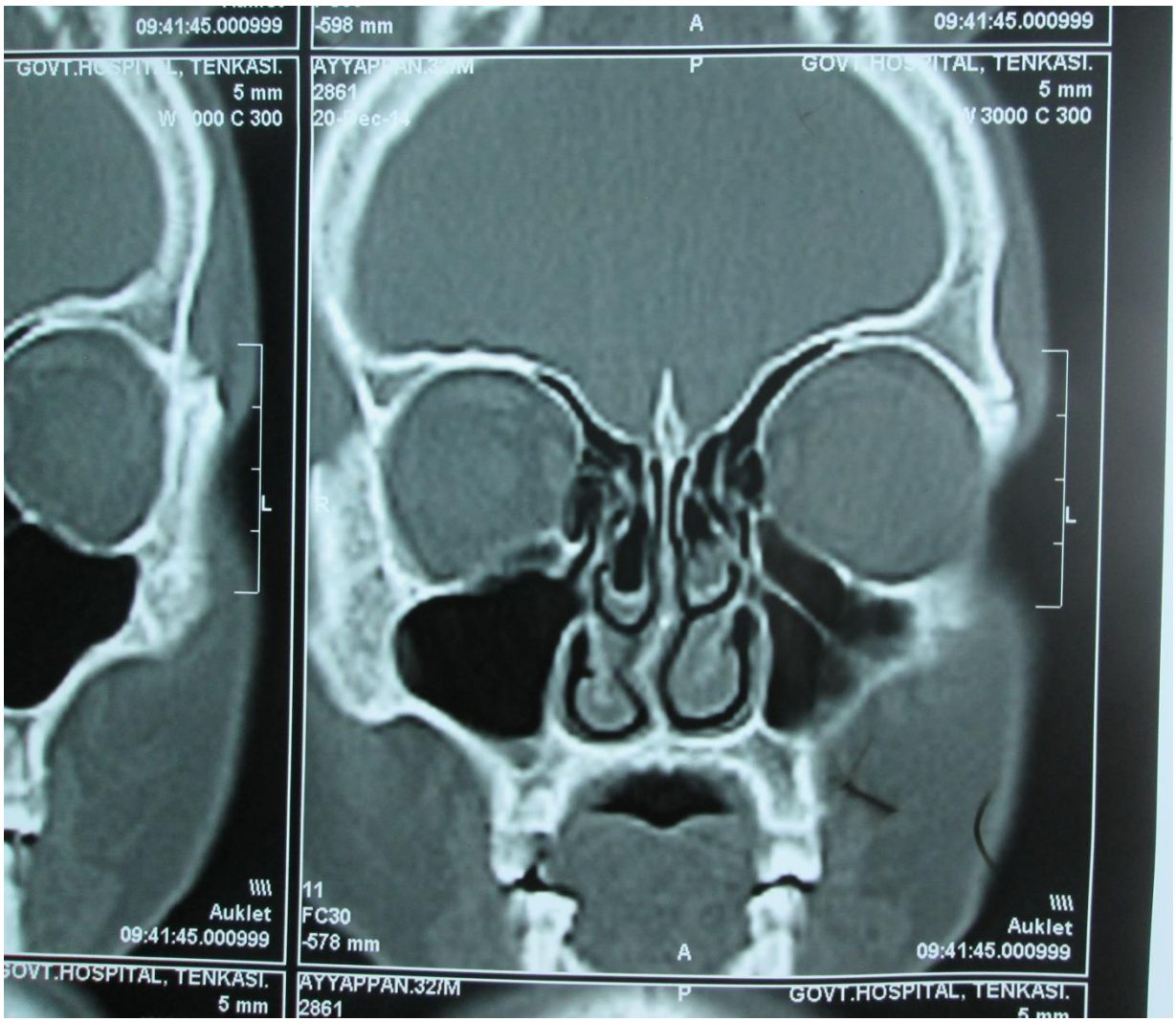


Figure 7: DEVIATED NASAL SEPTUM WITH NARROWED OSTEOMEATAL COMPLEX

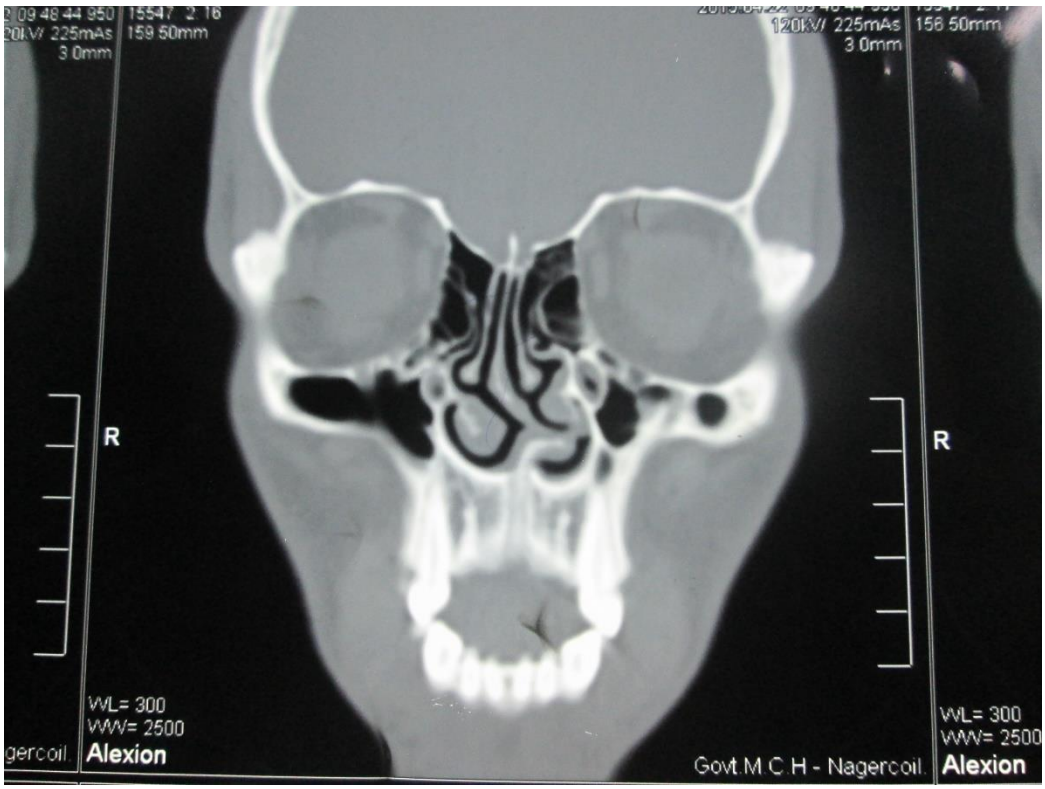


Figure 8: SINONASAL POLYPOSIS WITH BI-LATERAL MAXILLARY SINUSITIS

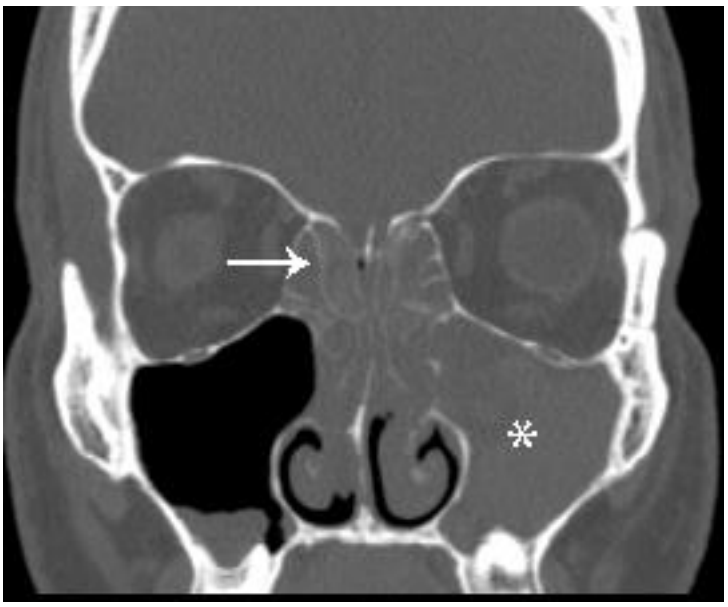


Figure 9: DEVIATED NASAL SEPTUM WITH LEFT MAXILLARY SINUSITIS

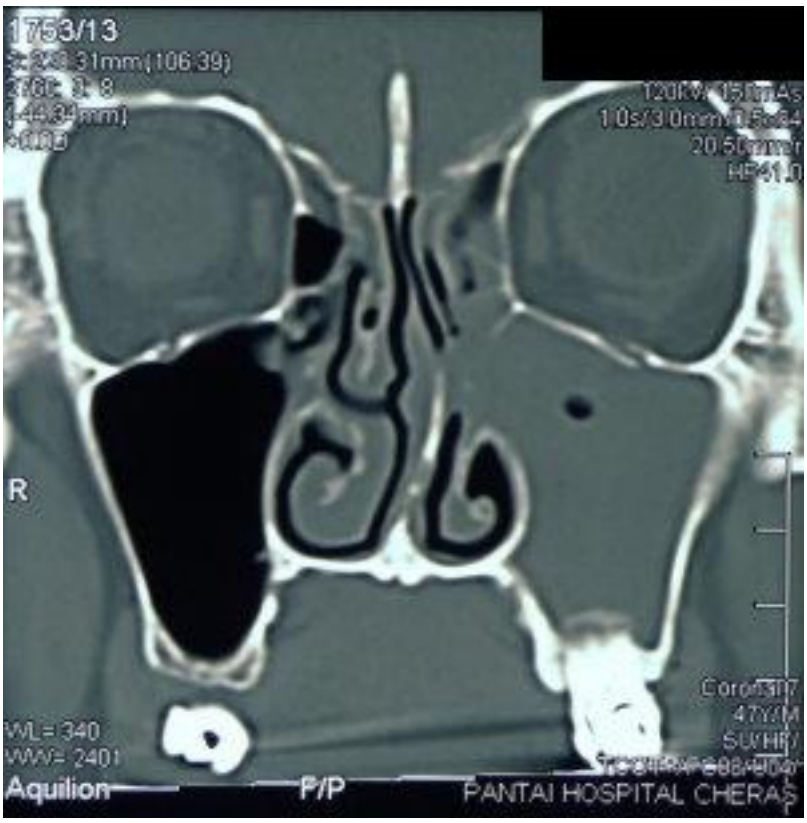
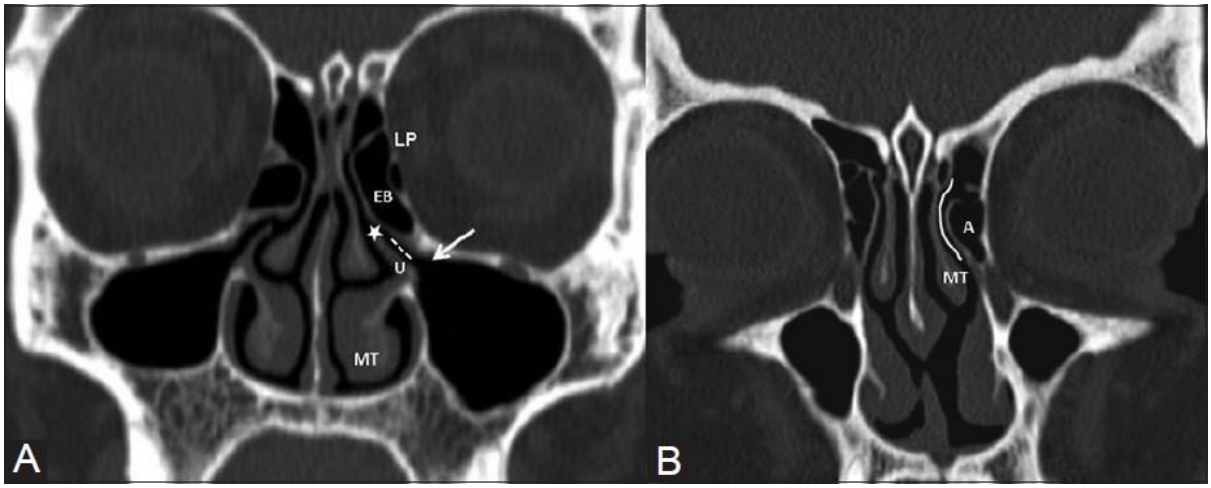


Figure 10: MEDIALISED UNCINATED PROCESS OBSTRUCTING OSTEOMEATAL COMPLEX



OTOENDOSCOPY

Figure 11: LARGE CENTRAL PERFORATION WITH DISCHARGE

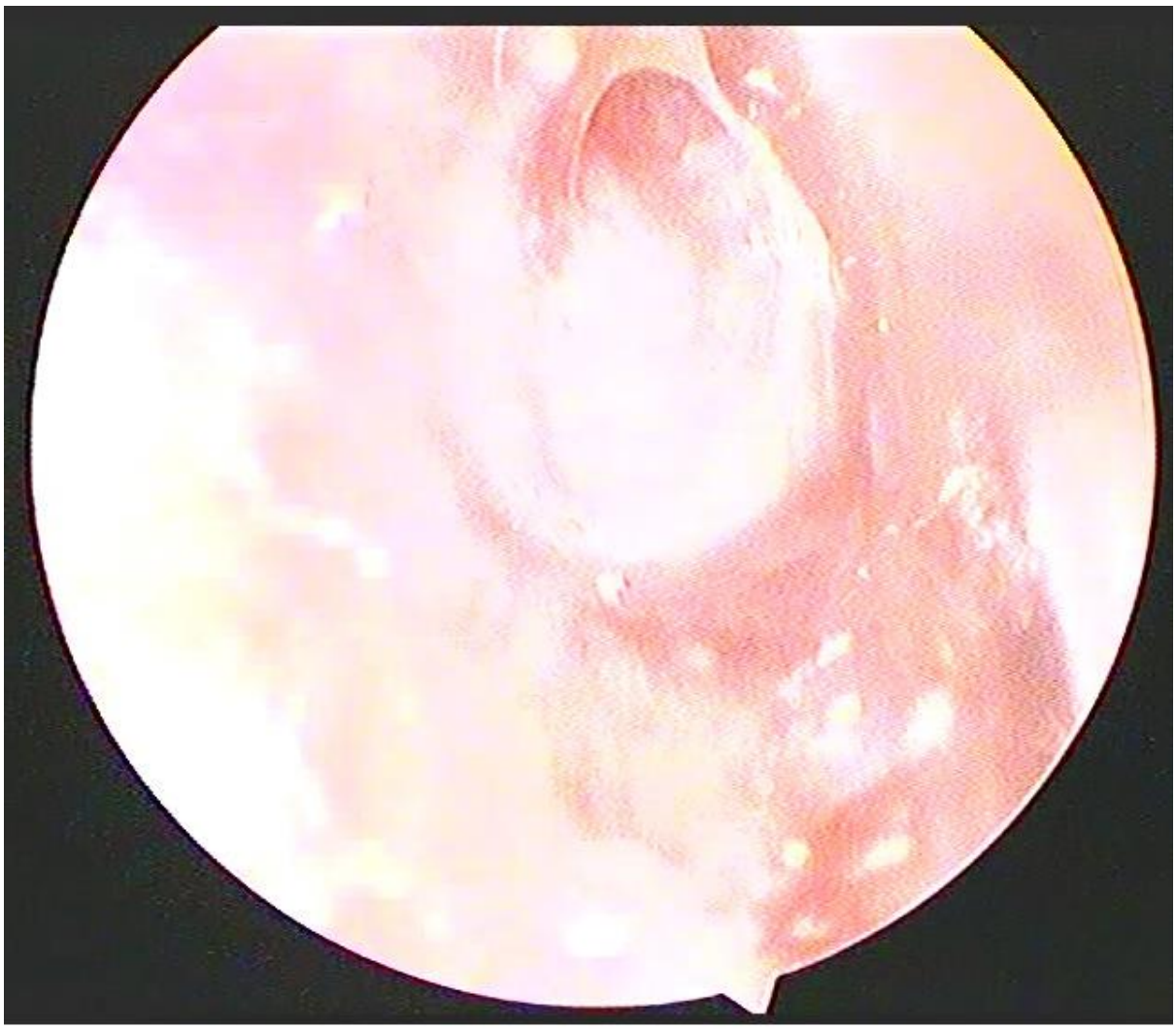


Figure 12: MEDIUM SIZE CENTRAL PERFORATION WITH MIDDLE EAR MUCOSA CONGESTION

Figure 13: SMALL CENTRAL PERFORATION

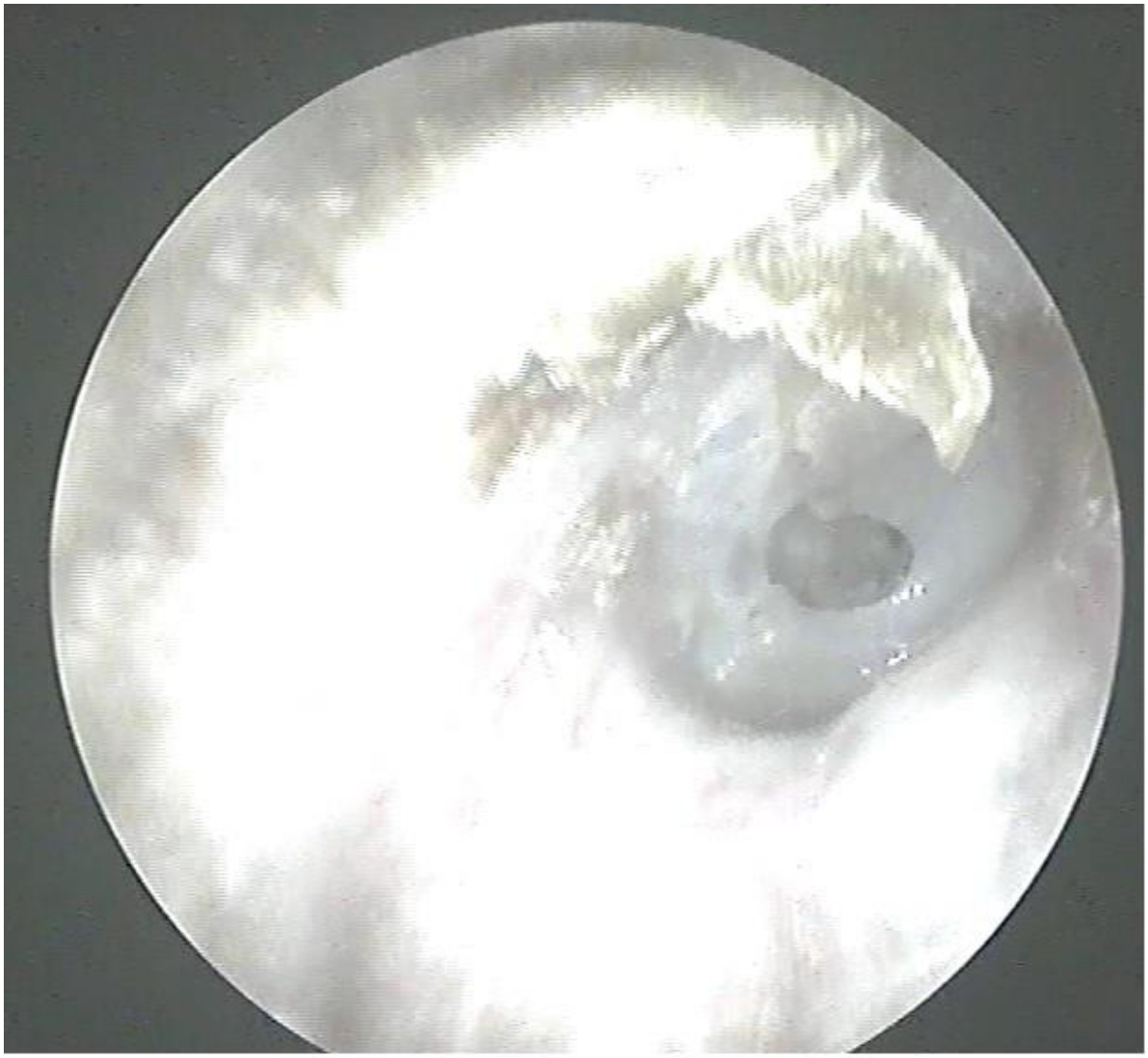


Figure 14: MEDIUM CENTRAL PERFORATION WITH REDUCTION IN SIZE

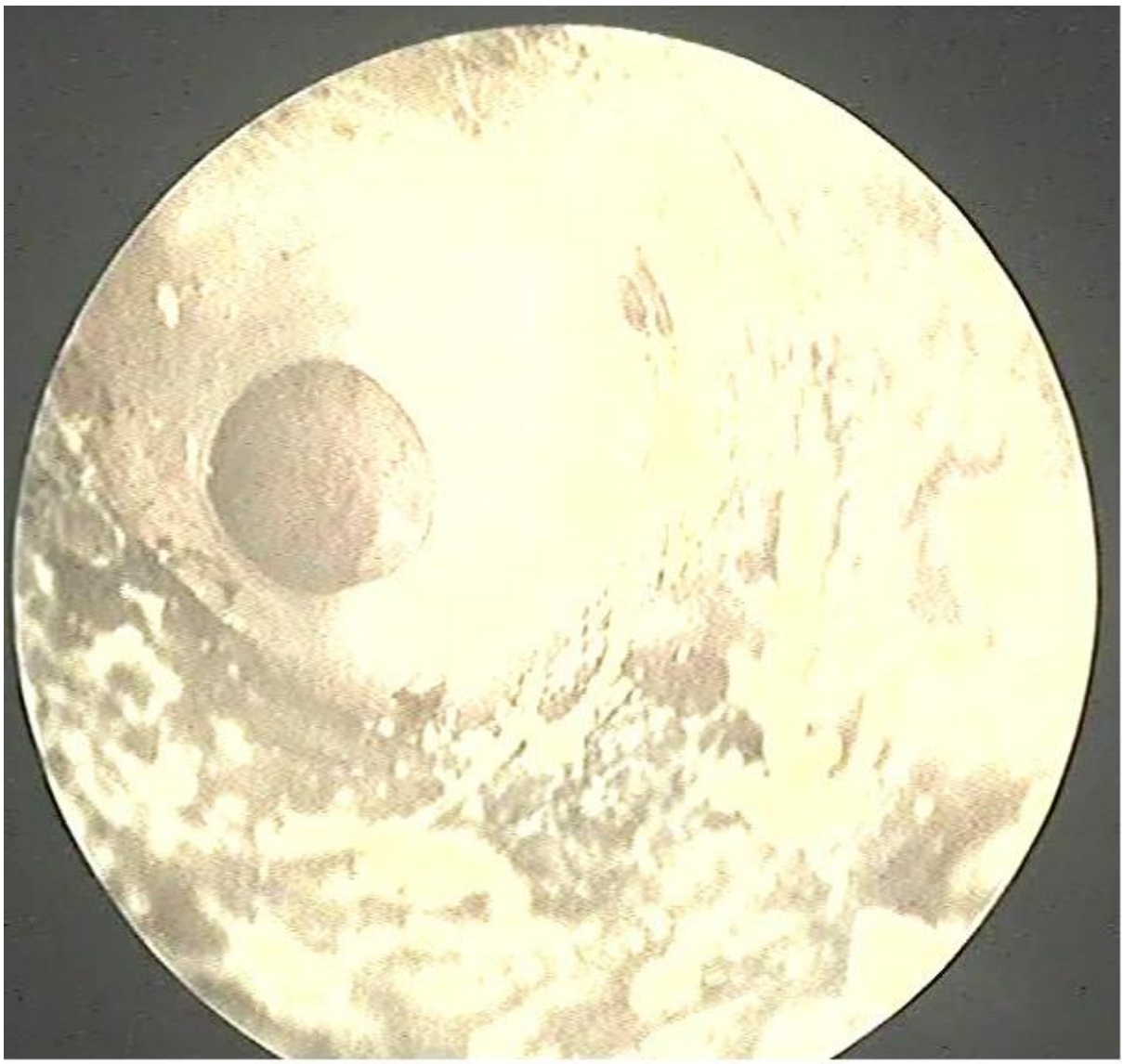
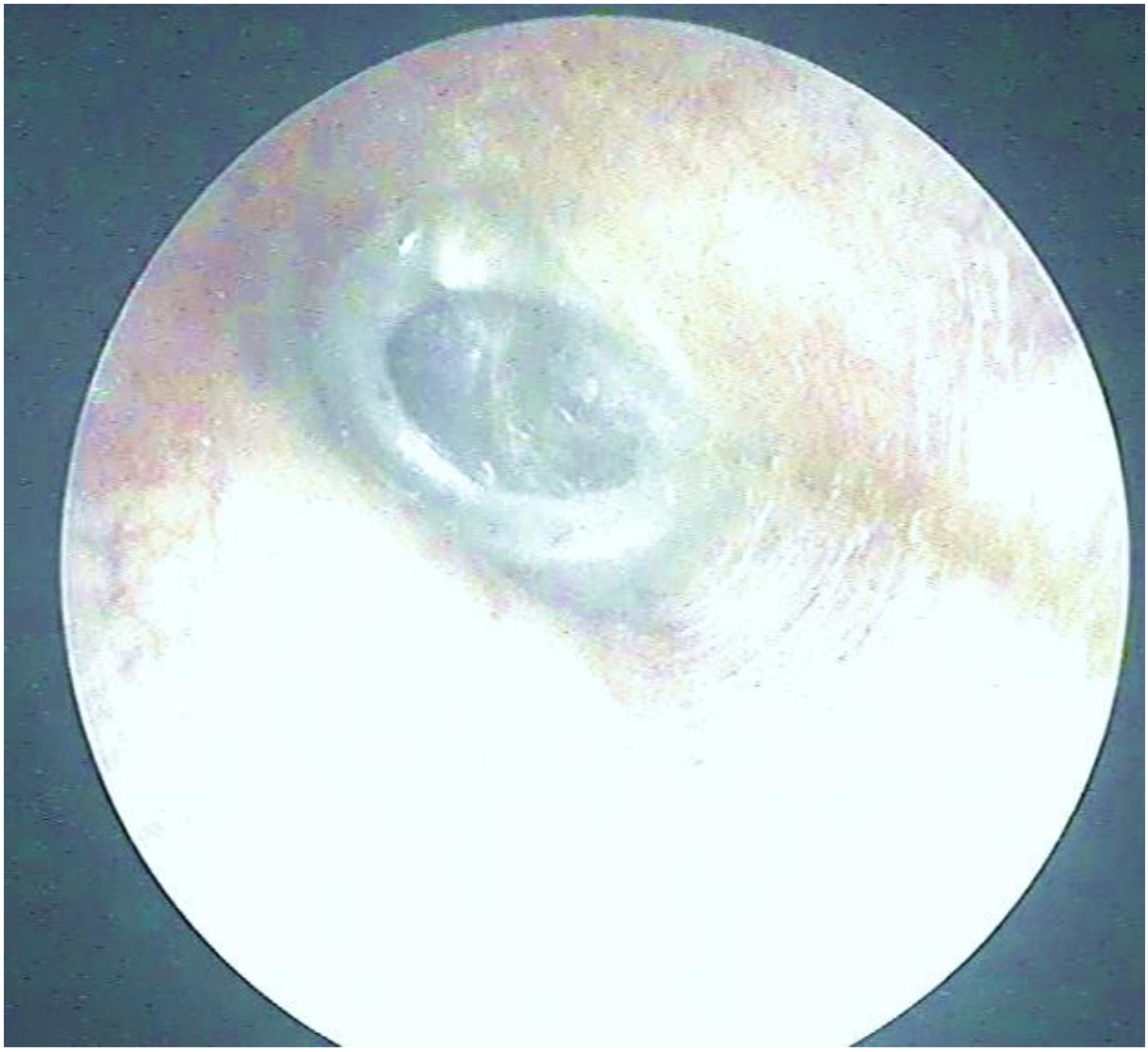
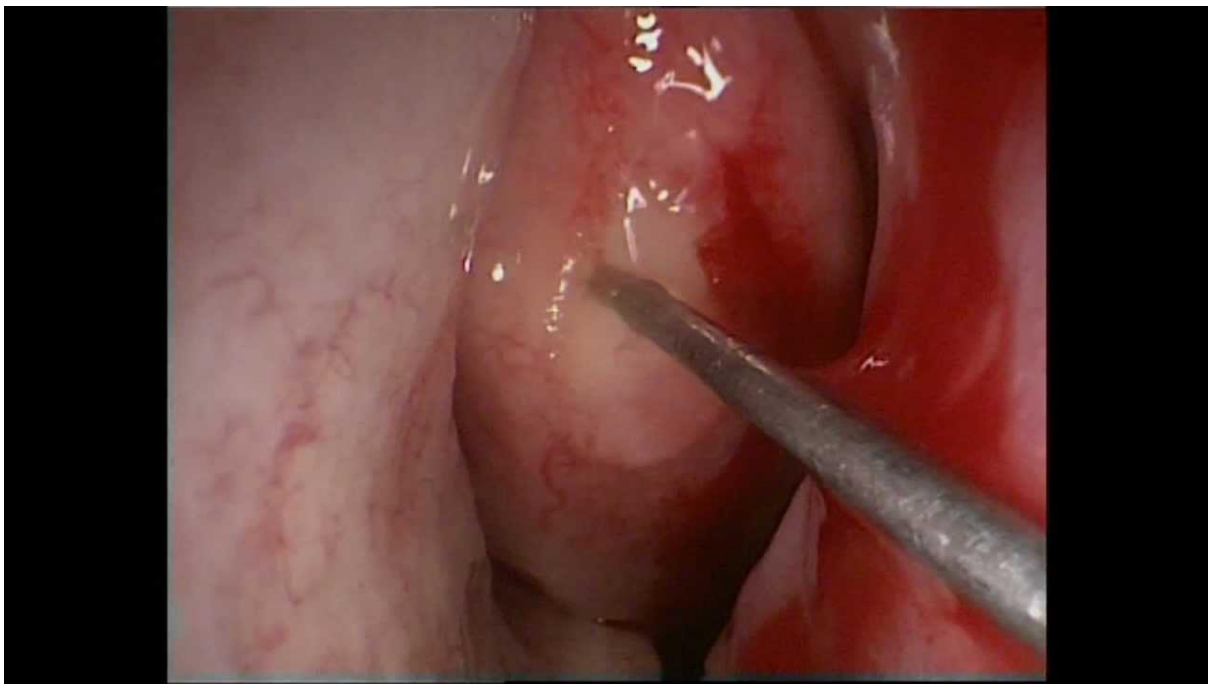


Figure 15: HEALED CENTRAL PERFORATION



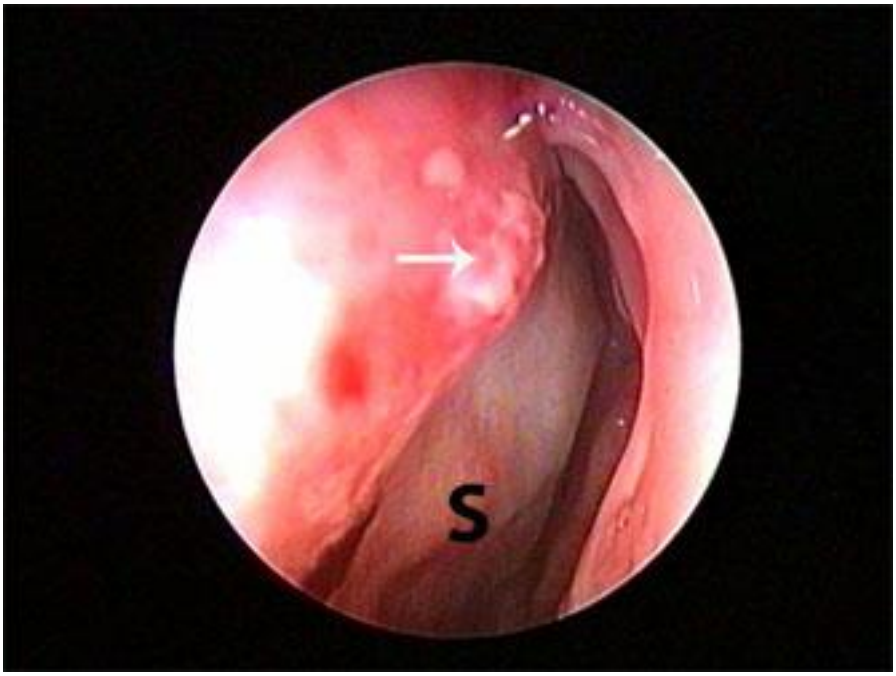
DIAGNOSTIC NASAL ENDOSCOPY

Figure 16: SHOWING PROMINENT MIDDLE TURBINATE



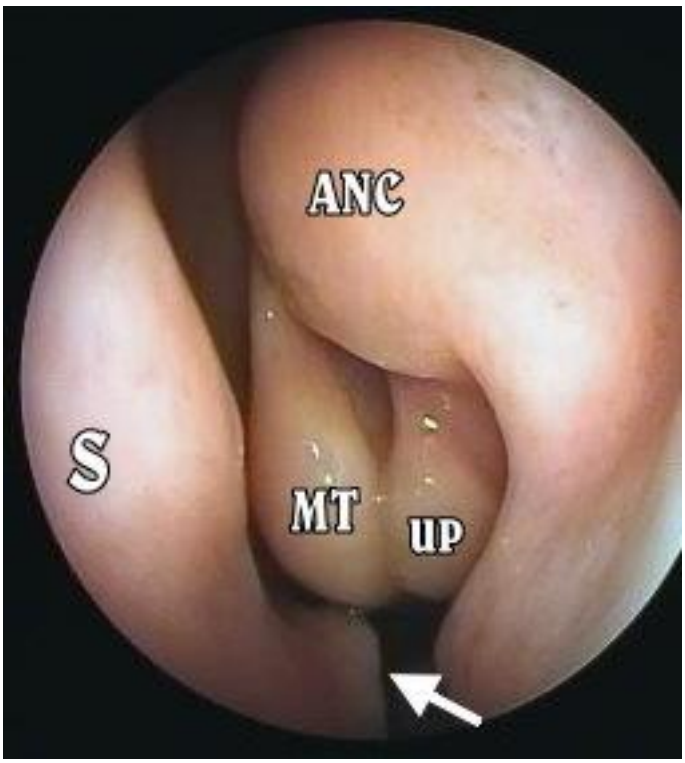
DIAGNOSTIC NASAL ENDOSCOPY

Figure 17: SHOWING DEVIATED NASAL SEPTUM



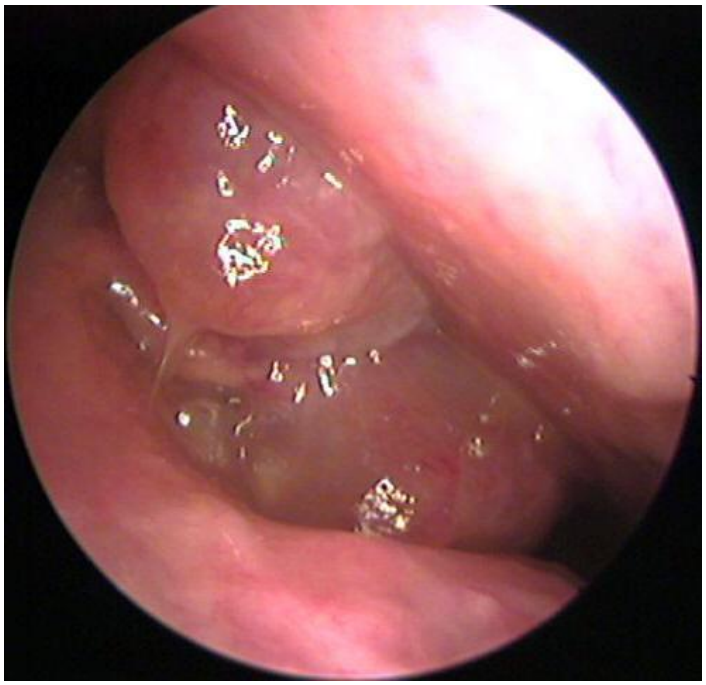
DIAGNOSTIC NASAL ENDOSCOPY

Figure 18: SHOWING MEDIALIZED UNCINATE PROCESS



DIAGNOSTIC NASAL ENDOSCOPY

Figure 19: SHOWING SINONASAL POLYPOSIS



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Sl. No.	Name	Age	Sex	IP No	Pre Operative Finding									Surgery	Post Operative Finding																
					DNE Findings						CTPNS Findings	Otoendoscopy			DNE Findings						Otoendoscopy										
																					At 3 Weeks			At 6 Weeks			At 3 Months			At 6 Months		
					Septum	Prominent Middle Turbinate	Medialised Uncinate Process	Enlarged Bulla	Prominent Agar	Polyps		Size of Perforation	Middle Ear Mucosal Status		Crust	Lateralisation of Middle Turbinate	Discharge	Polyps	Synechiae	Size of MMA	Middle Ear Mucosal Status	Discharge	Size of Perforation	Middle Ear Mucosal Status	Discharge	Size of Perforation	Middle Ear Mucosal Status	Discharge	Size of Perforation	Middle Ear Mucosal Status	Discharge	Size of Perforation
1	Chellapah	65	M	50435	DNS	Absent	Present	Present	Absent	Absent	GR-IV	Large	Congested	FESS with SEPTAL Correction	Absent	Present	Absent	Absent	Present	Not patent	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same
2	Maruthu Pandian	25	M	52759	DNS	Absent	Absent	Present	Present	Absent	GR-II	Small	Congested	FESS with SEPTAL Correction	Absent	Absent	Present	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Dry	Absent	Same	Dry	Absent	Reduced
3	Balu	50	M	50894	Midline	Absent	Present	Present	Absent	Present	GR-III	Large	Congested	Fess	Present	Absent	Present	Present	Absent	Not patent	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same
4	Vinayagam	45	M	52259	DNS	Present	Absent	Absent	Absent	Absent	GR-III	Large	Congested	FESS with SEPTAL Correction	Absent	Present	Absent	Absent	Present	Not patent	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same
5	Seethalakshmi	45	F	52248	Midline	Absent	Absent	Present	Present	Absent	GR-III	Medium	Congested	Fess	Absent	Absent	Present	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Dry	Absent	Same	Dry	Absent	Reduced
6	Antony raj	67	M	53931	DNS	Present	Absent	Present	Absent	Absent	GR-IV	Large	Congested	FESS with SEPTAL Correction	Absent	Present	Absent	Absent	Present	Not patent	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same
7	Ganapathy	59	M	53959	DNS	Present	Absent	Absent	Absent	Absent	GR-II	Medium	Congested	FESS with SEPTAL Correction	Absent	Absent	Present	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Congested	Absent	Reduced	Dry	Absent	Reduced
8	Thangamuhila	6	F	55247	DNS	Absent	Absent	Present	Present	Absent	GR-II	Large	Congested	FESS with SEPTAL Correction	Absent	Absent	Present	Present	Absent	Not patent	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same
9	Raju	45	M	55245	DNS	Present	Absent	Absent	Absent	Absent	GR-I	Small	Congested	FESS with SEPTAL Correction	Absent	Absent	Present	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Dry	Absent	Same	Dry	Absent	Reduced
10	Sarpoodhini	42	F	58058	DNS	Absent	Present	Present	Absent	Absent	GR-II	Medium	Congested	FESS with SEPTAL Correction	Absent	Absent	Present	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Dry	Absent	Same	Dry	Absent	Reduced
11	Sankar	35	M	60674	DNS	Absent	Present	Present	Absent	Absent	GR-I	Medium	Congested	FESS with SEPTAL Correction	Absent	Absent	Present	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Dry	Absent	Same	Dry	Absent	Reduced
12	Saritha	30	F	61536	DNS	Absent	Present	Present	Absent	Absent	GR-II	Large	Congested	FESS with SEPTAL Correction	Absent	Absent	Present	Present	Absent	Not patent	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same
13	Kumar	27	M	62054	Midline	Absent	Absent	Present	Present	Absent	GR-II	Medium	Congested	Fess	Absent	Absent	Present	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Dry	Absent	Same	Dry	Absent	Reduced
14	Chockalingam	58	M	65116	DNS	Present	Absent	Absent	Absent	Absent	GR-III	Large	Congested	FESS with SEPTAL Correction	Absent	Present	Absent	Absent	Present	Not patent	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same

15	Ramesh Kumar	29	M	65679	Midline	Present	Absent	Absent	Absent	Absent	GR-IV	Large	Congested	Fess	Absent	Present	Absent	Absent	Present	Not patent	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same
16	Muthu Manikandan	21	M	67137	DNS	Absent	Present	Present	Absent	Absent	GR-II	Small	Congested	FESS with SEPTAL Correction	Absent	Absent	Absent	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Dry	Absent	Reduced	Dry	Absent	Closed
17	Kannan	21	M	67630	Midline	Absent	Present	Present	Absent	Absent	GR-I	Small	Congested	Fess	Absent	Absent	Absent	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Dry	Absent	Reduced	Dry	Absent	Closed
18	Abitha	14	F	64148	DNS	Present	Absent	Absent	Absent	Absent	GR-III	Medium	Congested	FESS with SEPTAL Correction	Absent	Absent	Present	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Dry	Absent	Same	Dry	Absent	Reduced
19	Jenetha Rani	42	F	70107	DNS	Present	Absent	Present	Absent	Absent	GR-IV	Large	Congested	FESS with SEPTAL Correction	Absent	Present	Absent	Absent	Present	Not patent	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same
20	Jothi Muthu	37	M	70174	Midline	Absent	Present	Present	Absent	Absent	GR-III	Large	Congested	Fess	Absent	Absent	Present	Present	Absent	Not patent	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same
21	Antony	66	M	70675	DNS	Absent	Present	Present	Absent	Absent	GR-II	Small	Congested	FESS with SEPTAL Correction	Absent	Absent	Present	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Dry	Absent	Same	Dry	Absent	Reduced
22	Kalathiyan	28	M	72891	Midline	Present	Absent	Present	Absent	Absent	GR-IV	Large	Congested	Fess	Present	Absent	Absent	Absent	Present	Not patent	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same
23	Lakshmi	64	F	72875	Midline	Absent	Absent	Present	Present	Absent	GR-III	Medium	Congested	Fess	Present	Absent	Present	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Dry	Absent	Same	Dry	Absent	Reduced
24	Muthulakshmi	35	F	73388	Midline	Absent	Present	Present	Absent	Absent	GR-III	Large	Congested	Fess	Absent	Absent	Present	Present	Absent	Not patent	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same
25	Thirumalai Kolundu	19	M	73389	Midline	Present	Present	Absent	Absent	Absent	GR-I	Small	Congested	Fess	Absent	Absent	Present	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Dry	Absent	Same	Dry	Absent	Reduced
26	Abdul Kadar	23	M	1338	DNS	Present	Absent	Absent	Absent	Absent	GR-II	Medium	Congested	FESS with SEPTAL Correction	Absent	Absent	Present	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Dry	Absent	Same	Dry	Absent	Reduced
27	Saravan Suresh	34	M	1353	DNS	Absent	Present	Present	Absent	Absent	GR-II	Medium	Congested	FESS with SEPTAL Correction	Absent	Absent	Present	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Dry	Absent	Same	Dry	Absent	Reduced
28	Muthulakshmi	38	F	3830	DNS	Absent	Present	Present	Absent	Absent	GR-IV	Large	Congested	FESS with SEPTAL Correction	Absent	Absent	Present	Present	Absent	Not patent	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same
29	Devika	46	F	4646	Midline	Present	Absent	Absent	Absent	Absent	GR-III	Large	Congested	Fess	Absent	Present	Absent	Absent	Present	Not patent	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same
30	Ragu Prabhu	32	M	7307	DNS	Present	Absent	Present	Absent	Absent	GR-II	Large	Congested	FESS with SEPTAL Correction	Absent	Present	Absent	Absent	Absent	Not patent	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same
31	Manikandan	22	M	8700	Midline	Absent	Absent	Present	Present	Absent	GR-I	Small	Congested	Fess	Absent	Absent	Absent	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Dry	Absent	Reduced	Dry	Absent	Closed

32	Kumar	37	M	8680	DNS	Absent	Present	Present	Absent	Absent	GR-II	Large	Congested	FESS with SEPTAL Correction	Absent	Absent	Present	Present	Absent	Not patent	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same
33	Malliga	30	F	8661	DNS	Absent	Present	Present	Absent	Absent	GR-I	Small	Congested	FESS with SEPTAL Correction	Absent	Absent	Absent	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Dry	Absent	Reduced	Dry	Absent	Closed
34	Syead Ali Fathima	28	F	5167	DNS	Absent	Absent	Present	Absent	Absent	GR-II	Medium	Congested	FESS with SEPTAL Correction	Absent	Absent	Present	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Dry	Absent	Same	Dry	Absent	Reduced
35	Murugeshwari	41	F	8681	DNS	Present	Absent	Absent	Absent	Absent	GR-II	Medium	Congested	FESS with SEPTAL Correction	Absent	Absent	Present	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Dry	Absent	Same	Dry	Absent	Reduced
36	Thanga Permual	40	M	9583	DNS	Present	Absent	Present	Absent	Absent	GR-IV	Large	Congested	FESS with SEPTAL Correction	Absent	Present	Absent	Absent	Present	Not patent	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same
37	Valli kumar	27	M	9590	Midline	Present	Absent	Present	Absent	Absent	GR-III	Large	Congested	Fess	Absent	Absent	Present	Present	Absent	Not patent	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same
38	Kuttiammal	15	F	8122	Midline	Absent	Absent	Present	Present	Absent	GR-II	Small	Congested	Fess	Absent	Absent	Present	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Dry	Absent	Same	Dry	Absent	Reduced
39	Sudhakar	20	M	10068	DNS	Absent	Absent	Present	Present	Present	GR-IV	Large	Congested	FESS with SEPTAL Correction	Absent	Absent	Present	Present	Absent	Not patent	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same
40	Karupasamy	24	M	11451	Midline	Present	Present	Absent	Absent	Absent	GR-II	Small	Congested	Fess	Absent	Absent	Present	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Dry	Absent	Same	Dry	Absent	Reduced
41	Muthupandi	29	M	12999	Midline	Present	Absent	Present	Absent	Present	GR-II	Large	Congested	Fess	Absent	Absent	Present	Present	Absent	Not patent	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same
42	Muthu Krishnan	30	M	18465	DNS	Absent	Absent	Present	Present	Absent	GR-I	Medium	Congested	FESS with SEPTAL Correction	Absent	Absent	Present	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Dry	Absent	Same	Dry	Absent	Reduced
43	Gayathri	35	F	13479	DNS	Present	Absent	Absent	Absent	Absent	GR-II	Medium	Congested	FESS with SEPTAL Correction	Absent	Absent	Present	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Dry	Absent	Same	Dry	Absent	Reduced
44	Narayana Vadivu	39	F	14837	Midline	Present	Present	Absent	Absent	Absent	GR-II	Small	Congested	Fess	Absent	Present	Present	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Dry	Absent	Same	Dry	Absent	Reduced
45	Rama	41	F	14815	DNS	Absent	Absent	Present	Present	Present	GR-II	Large	Congested	FESS with SEPTAL Correction	Absent	Absent	Present	Present	Absent	Not patent	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same
46	Manohar	22	M	15165	DNS	Present	Present	Absent	Absent	Absent	GR-III	Medium	Congested	FESS with SEPTAL Correction	Absent	Absent	Present	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Dry	Absent	Same	Dry	Absent	Reduced
47	Asifa	14	F	16237	DNS	Present	Absent	Present	Present	Absent	GR-I	Medium	Congested	FESS with SEPTAL Correction	Absent	Absent	Present	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Dry	Absent	Same	Dry	Absent	Reduced
48	Rekha	19	F	16227	DNS	Present	Absent	Present	Absent	Present	GR-II	Large	Congested	FESS with SEPTAL Correction	Absent	Absent	Present	Present	Absent	Not patent	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same

49	Pichikani	55	F	16259	DNS	Present	Present	Absent	Absent	Absent	GR-II	Small	Congested	FESS with SEPTAL Correction	Absent	Absent	Present	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Dry	Absent	Same	Dry	Absent	Reduced
50	Petchimuthu	25	M	17115	DNS	Absent	Absent	Present	Present	Absent	GR-I	Medium	Congested	FESS with SEPTAL Correction	Absent	Absent	Present	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Dry	Absent	Same	Dry	Absent	Reduced
51	Poomari	40	F	17551	DNS	Absent	Present	Present	Absent	Absent	GR-IV	Large	Congested	FESS with SEPTAL Correction	Absent	Present	Absent	Absent	Present	Not patent	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same
52	Chellaiah	38	M	17548	DNS	Absent	Absent	Present	Present	Absent	GR-II	Small	Congested	FESS with SEPTAL Correction	Absent	Absent	Present	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Dry	Absent	Same	Dry	Absent	Reduced
53	Ganesan	40	M	18413	Midline	Absent	Present	Present	Absent	Present	GR-III	Large	Congested	Fess	Present	Absent	Present	Present	Absent	Not patent	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same
54	Prabhaker	28	M	18463	DNS	Present	Absent	Absent	Absent	Absent	GR-III	Large	Congested	FESS with SEPTAL Correction	Absent	Present	Absent	Absent	Present	Not patent	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same
55	Grace	37	F	18427	Midline	Absent	Absent	Present	Present	Absent	GR-III	Medium	Congested	Fess	Absent	Absent	Present	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Dry	Absent	Same	Dry	Absent	Reduced
56	Mallika	30	F	18430	DNS	Present	Absent	Present	Absent	Absent	GR-IV	Large	Congested	FESS with SEPTAL Correction	Absent	Present	Absent	Absent	Present	Not patent	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same
57	Velliathai	37	F	18889	DNS	Present	Absent	Absent	Absent	Absent	GR-II	Medium	Congested	FESS with SEPTAL Correction	Absent	Absent	Present	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Congested	Absent	Reduced	Dry	Absent	Reduced
58	Gunasekar	35	M	18892	DNS	Absent	Absent	Present	Present	Absent	GR-II	Large	Congested	FESS with SEPTAL Correction	Absent	Absent	Present	Present	Absent	Not patent	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same
59	Jeneth	23	F	19849	DNS	Present	Absent	Absent	Absent	Absent	GR-I	Small	Congested	FESS with SEPTAL Correction	Absent	Absent	Present	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Dry	Absent	Same	Dry	Absent	Reduced
60	Ganapathy Ammal	19	F	20241	DNS	Absent	Present	Present	Absent	Absent	GR-II	Medium	Congested	FESS with SEPTAL Correction	Absent	Absent	Present	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Dry	Absent	Same	Dry	Absent	Reduced
61	Mahesh	29	M	21213	DNS	Absent	Present	Present	Absent	Absent	GR-I	Medium	Congested	FESS with SEPTAL Correction	Absent	Absent	Present	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Dry	Absent	Same	Dry	Absent	Reduced
62	Chellaiah	55	M	22434	DNS	Absent	Present	Present	Absent	Absent	GR-II	Large	Congested	FESS with SEPTAL Correction	Absent	Absent	Present	Present	Absent	Not patent	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same
63	Pushpa	26	F	23861	Midline	Absent	Absent	Present	Present	Absent	GR-II	Medium	Congested	Fess	Absent	Absent	Present	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Dry	Absent	Same	Dry	Absent	Reduced
64	Murugan	40	M	23838	DNS	Present	Absent	Absent	Absent	Absent	GR-III	Large	Congested	FESS with SEPTAL Correction	Absent	Present	Absent	Absent	Present	Not patent	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same
65	Kalishwaran	26	M	24393	Midline	Present	Absent	Absent	Absent	Absent	GR-IV	Large	Congested	Fess	Absent	Present	Absent	Absent	Present	Not patent	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same

66	UlaganathaN	25	M	24389	DNS	Absent	Present	Present	Absent	Absent	GR-II	Small	Congested	FESS with SEPTAL Correction	Absent	Absent	Absent	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Dry	Absent	Reduced	Dry	Absent	Closed
67	Thangamani	17	M	25794	Midline	Absent	Present	Present	Absent	Absent	GR-I	Small	Congested	Fess	Absent	Absent	Absent	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Dry	Absent	Reduced	Dry	Absent	Closed
68	Augustin	25	M	25782	DNS	Present	Absent	Absent	Absent	Absent	GR-III	Medium	Congested	FESS with SEPTAL Correction	Absent	Absent	Present	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Dry	Absent	Same	Dry	Absent	Reduced
69	Raja	23	M	25776	DNS	Present	Absent	Present	Absent	Absent	GR-IV	Large	Congested	FESS with SEPTAL Correction	Absent	Present	Absent	Absent	Present	Not patent	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same
70	Gomuraj	28	M	26846	Midline	Absent	Present	Present	Absent	Absent	GR-III	Large	Congested	Fess	Absent	Absent	Present	Present	Absent	Not patent	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same
71	Karuvel	45	M	27381	DNS	Absent	Present	Present	Absent	Absent	GR-II	Small	Congested	FESS with SEPTAL Correction	Absent	Absent	Present	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Dry	Absent	Same	Dry	Absent	Reduced
72	Ramar	41	M	27316	Midline	Present	Absent	Present	Absent	Absent	GR-IV	Large	Congested	Fess	Present	Absent	Absent	Absent	Present	Not patent	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same
73	Kalpana	21	F	29779	Midline	Absent	Absent	Present	Present	Absent	GR-III	Medium	Congested	Fess	Present	Absent	Present	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Dry	Absent	Same	Dry	Absent	Reduced
74	Seetharaman	31	M	31805	Midline	Absent	Present	Present	Absent	Absent	GR-III	Large	Congested	Fess	Absent	Absent	Present	Present	Absent	Not patent	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same
75	Ramavathi	42	F	34272	Midline	Present	Present	Absent	Absent	Absent	GR-I	Small	Congested	Fess	Absent	Absent	Present	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Dry	Absent	Same	Dry	Absent	Reduced
76	Poomari	40	F	34359	DNS	Present	Absent	Absent	Absent	Absent	GR-II	Medium	Congested	FESS with SEPTAL Correction	Absent	Absent	Present	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Dry	Absent	Same	Dry	Absent	Reduced
77	Lakshmi	40	F	34816	DNS	Absent	Present	Present	Absent	Absent	GR-II	Medium	Congested	FESS with SEPTAL Correction	Absent	Absent	Present	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Dry	Absent	Same	Dry	Absent	Reduced
78	Seyalisamy	46	M	34264	DNS	Absent	Present	Present	Absent	Absent	GR-IV	Large	Congested	FESS with SEPTAL Correction	Absent	Absent	Present	Present	Absent	Not patent	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same
79	Petchiammal	36	F	34267	Midline	Present	Absent	Absent	Absent	Absent	GR-III	Large	Congested	Fess	Absent	Present	Absent	Absent	Present	Not patent	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same
80	Subash	18	M	35867	DNS	Present	Absent	Present	Absent	Absent	GR-II	Large	Congested	FESS with SEPTAL Correction	Absent	Present	Absent	Absent	Absent	Not patent	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same
81	Vairajothi	25	F	36136	Midline	Absent	Absent	Present	Present	Absent	GR-I	Small	Congested	Fess	Absent	Absent	Absent	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Dry	Absent	Reduced	Dry	Absent	Closed
82	Selvaraj	29	M	35848	DNS	Absent	Present	Present	Absent	Absent	GR-II	Large	Congested	FESS with SEPTAL Correction	Absent	Absent	Present	Present	Absent	Not patent	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same

83	Suresh	19	M	37332	DNS	Absent	Present	Present	Absent	Absent	GR-I	Small	Congested	FESS with SEPTAL Correction	Absent	Absent	Absent	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Dry	Absent	Reduced	Dry	Absent	Closed
84	Rajavinoth	24	M	37334	DNS	Absent	Absent	Present	Absent	Absent	GR-II	Medium	Congested	FESS with SEPTAL Correction	Absent	Absent	Present	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Dry	Absent	Same	Dry	Absent	Reduced
85	Petchimuthu	25	M	37762	DNS	Present	Absent	Absent	Absent	Absent	GR-II	Medium	Congested	FESS with SEPTAL Correction	Absent	Absent	Present	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Dry	Absent	Same	Dry	Absent	Reduced
86	Maha	14	F	37281	DNS	Present	Absent	Present	Absent	Absent	GR-IV	Large	Congested	FESS with SEPTAL Correction	Absent	Present	Absent	Absent	Present	Not patent	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same
87	Kalai	31	F	38746	Midline	Present	Absent	Present	Absent	Absent	GR-III	Large	Congested	Fess	Absent	Absent	Present	Present	Absent	Not patent	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same
88	Ponnudurai	63	M	39262	Midline	Absent	Absent	Present	Present	Absent	GR-II	Small	Congested	Fess	Absent	Absent	Present	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Dry	Absent	Same	Dry	Absent	Reduced
89	Sivasubramanian	53	M	40220	DNS	Absent	Absent	Present	Present	Present	GR-IV	Large	Congested	FESS with SEPTAL Correction	Absent	Absent	Present	Present	Absent	Not patent	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same
90	Rajeshwari	35	F	41629	Midline	Present	Present	Absent	Absent	Absent	GR-II	Small	Congested	Fess	Absent	Absent	Present	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Dry	Absent	Same	Dry	Absent	Reduced
91	Mariammal	35	F	41635	Midline	Present	Absent	Present	Absent	Present	GR-II	Large	Congested	Fess	Absent	Absent	Present	Present	Absent	Not patent	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same
92	Ganesh	19	M	41619	DNS	Absent	Absent	Present	Present	Absent	GR-I	Medium	Congested	FESS with SEPTAL Correction	Absent	Absent	Present	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Dry	Absent	Same	Dry	Absent	Reduced
93	Selvamurugan	46	M	41626	DNS	Present	Absent	Absent	Absent	Absent	GR-II	Medium	Congested	FESS with SEPTAL Correction	Absent	Absent	Present	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Dry	Absent	Same	Dry	Absent	Reduced
94	Rajasekar	40	M	41820	Midline	Present	Present	Absent	Absent	Absent	GR-II	Small	Congested	Fess	Absent	Present	Present	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Dry	Absent	Same	Dry	Absent	Reduced
95	Hariram	22	M	42649	DNS	Absent	Absent	Present	Present	Present	GR-II	Large	Congested	FESS with SEPTAL Correction	Absent	Absent	Present	Present	Absent	Not patent	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same
96	Kannan	31	M	42259	DNS	Present	Present	Absent	Absent	Absent	GR-III	Medium	Congested	FESS with SEPTAL Correction	Absent	Absent	Present	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Dry	Absent	Same	Dry	Absent	Reduced
97	Suresh	35	M	43636	DNS	Present	Absent	Present	Present	Absent	GR-I	Medium	Congested	FESS with SEPTAL Correction	Absent	Absent	Present	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Dry	Absent	Same	Dry	Absent	Reduced
98	Ramkumar	41	M	48662	DNS	Present	Absent	Present	Absent	Present	GR-II	Large	Congested	FESS with SEPTAL Correction	Absent	Absent	Present	Present	Absent	Not patent	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same
99	Jenita	22	F	49830	DNS	Present	Present	Absent	Absent	Absent	GR-II	Small	Congested	FESS with SEPTAL Correction	Absent	Absent	Present	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Dry	Absent	Same	Dry	Absent	Reduced

100	Mathiselvam	22	M	52916	DNS	Absent	Absent	Present	Present	Absent	GR-I	Medium	Congested	FESS with SEPTAL Correction	Absent	Absent	Present	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Dry	Absent	Same	Dry	Absent	Reduced
101	Perumal	19	M	34047	DNS	Absent	Present	Present	Absent	Absent	GR-IV	Large	Congested	FESS with SEPTAL Correction	Absent	Present	Absent	Absent	Present	Not patent	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same
102	Rukmani	66	F	34057	DNS	Absent	Absent	Present	Present	Absent	GR-II	Small	Congested	FESS with SEPTAL Correction	Absent	Absent	Present	Absent	Absent	Patent	Congested	Present	Same	Congested	Absent	Same	Dry	Absent	Same	Dry	Absent	Reduced
103	Saranya	20	F	35554	Midline	Absent	Present	Present	Absent	Present	GR-III	Large	Congested	Fess	Present	Absent	Present	Present	Absent	Not patent	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same
104	Palavasam	27	F	35598	DNS	Present	Absent	Absent	Absent	Absent	GR-III	Large	Congested	FESS with SEPTAL Correction	Absent	Present	Absent	Absent	Present	Not patent	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same	Congested	Present	Same